AN EXPENSIVE EXPERIMENT

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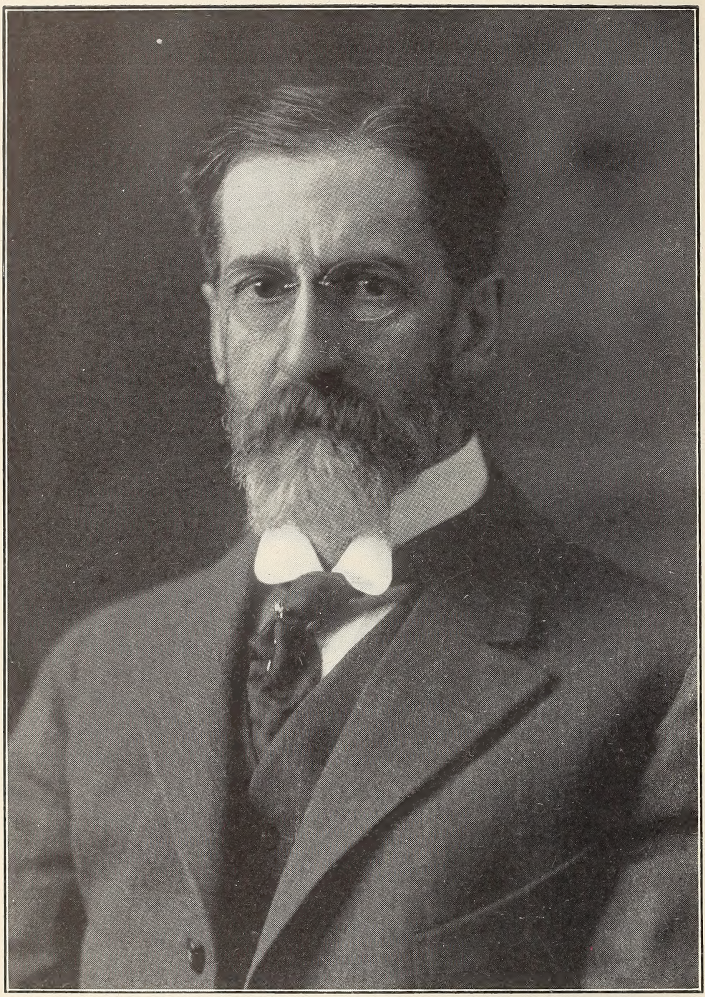

REGINALD PELHAM BOLTON.

AN
EXPENSIVE
EXPERIMENT

THE HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO

by

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BY
R. P. BOLTON

FOREWORD

THE citizens and taxpayers of the State of New York, confronted with a proposal for the expenditure of their money in an evidently ill-considered and distinctly ill-informed scheme of Governmental speculation in the electrical industry, fomented by radical and interested politicians under the guise of advocates of conservation, turned to a sister Province, for information as to the workings therein, of a Governmental experiment of the character proposed for their own adoption, and in its managers, exponents and advocates in the press, found:—

The same lofty disregard of plain figures and facts, the same wordy generalizations, the same assumption of being the sole savior of the people's interests, all covering:—

The same private greed on the part of manufacturing interests, and the same insistent demand for cheap conveniences on the part of those who can best afford to pay for them.

Applying to those who possessed them, for guiding information and real facts, they were met by disregard and neglect, when a fortunate circumstance, due to the disgust of one honest man with the methods and secrecy of those in command of the affairs of the Experiment, brought to their service the actual records upon which the disclosures herein were made possible. The aid rendered by that Honest Man without reward or remuneration can only be acknowledged by this statement since he has determined to refuse publicity for his service to the public.

For their painstaking investigation, involving much time, anxiety and inconvenience, the public of New York owe their State Committee a meed of gratitude, and for their courtesy in permitting his presence at their hearings and access to their sources of information, they have here the expression of the gratitude of the Author.

The purpose upon which this study was started, to inform the Taxpayers of the City of New York, of the facts relating to the attempt to fasten at their expense upon our State a speculative experiment, such as that of Ontario, has been extended, by personal investigation, enquiry and analysis, into a very large quantity of information, from which the contents of this volume have been compiled.

The facts and figures are official, they are confirmed by official statements and testimony, and have been written impartially from the standpoint of an engineer, a property owner, a taxpayer, and a citizen deeply concerned and actively interested in the general welfare of the public.

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CHAPTER I

THE BIRTH OF THE EXPERIMENT

THIS is the story of a Great Experiment undertaken by nearly three-quarters of a million of people, to which they have committed themselves and their successors for a quarter of a century to come, and in which they have involved themselves in a vast expenditure of public funds, and have shouldered a heavy burden of debt to demonstrate their belief in its possibilities.

It is an experiment which has involved the people of a great Province, in the surrender of some of their Constitutional privileges, and in a deprival of the rights of some of their neighbors; sacrifices so far uncomplainingly borne in the belief that the result may justify the means. An experiment born of a hopeful intention to secure the enlargement of business and the addition of wealth to the Province, and also with the desire of bringing prosperity and profit to the workshop and more convenience and comforts to the homes of the workers.

Utopian and sentimental as it may be considered, it nevertheless exhibits an unusual spirit of common devotion in its combination of all classes and interests in the effort, demonstrating a disregard of ultimate consequences, but reflecting in its purpose and aim, public spirit and interest in general welfare.

The experiment is one that has been founded upon the advance of modern invention in the electrical field, which has fastened itself upon the public imagination and perhaps to a greater extent than any of the great discoveries of the past century. The fascination of electricity is due, not only to the extraordinary field of its applications, but in part to its inexplicable character, and in part to the lack of general information upon its limitations. Such interest does not surround other subjects of simpler character, which could not have aroused the same degree of public attention, and could not have concentrated it to the same extent as has been the case with the people of the Province of Ontario.

Situated as is this part of Canada upon the bounds of the greatest waters of the continent, and possessing as it does in the Falls of Niagara one of the greatest international objects of interest in America, it is natural that the attention of its people should be readily directed towards any matter connected with these physical features; and that the subject of the development of power in the form of electricity, should be a matter occupying a large place in the public vision.

A combination of circumstances in the Province of Ontario has contributed to this result. From a prosperous agricultural country, Ontario has advanced into a rather prominent position in the manufacturing and industrial field; a progress which has brought particularly before the minds of its people subjects connected with industry and manufacture, which otherwise might have been of little concern to them.

The general agitation which has taken place within the past decade upon the subject of conservation of national resources, has found a field of ready acceptance in Ontario, where the natural resources of the country take the form of its timber, its streams and its water-falls, the latter conspicuously in evidence in almost every part of the Province. Such conditions have been utilized by those who have been engaged in creating a public interest in the phase of conservation involving governmental ownership and control, and their efforts have been substantially aided by the circumstance that the Province of Ontario possesses at no point within its boundaries, a supply of fuel in the form of coal. National sentiment has been drawn upon in aid of the movement, and much has been made of the dependence of the Province for its supplies of fuel, upon the resources of a neighboring country.

There is probably no combination of material of this character which could have been brought together to greater advantage for the creation of an effect upon public opinion, and it may be added that there are no subjects more generally misused in the form of generalities and exaggerations, than are electricity and water powers. The limitations of both of these forms of energy are widely misunderstood and their possibilities greatly over-estimated in the minds of many people who are not technically informed upon the subject. The fundamental facts that electricity is not a source of energy, but is merely a manufactured force, or rather a means of transmitting it, and that water powers, however majestic and apparently voluminous may be the falls or rapids, are limited by natural conditions, and are often expensive in their utilization, are points which do not appeal to the politician, the agitator, or the enthusiast, and are neither brought to the attention of, nor are generally understood by the public. The discussions which have taken place in this connection, have tended to magnify the possibilities and advantages of water power, while exaggerated and alarming statements have been made as to the exhaustion of coal, and the destruction of forests, producing the effect upon the public mind, that the situation demands the immediate utilization of other means for the production of power and heat, rather than the much more evident requirement of reasonable economy and improved utilization of the various fuel supplies at present available, and the provision of better means of transportation of supplies derivable from more distant sources.

The course of affairs in this regard in Ontario has followed such lines of public misdirection. Generalizations and vast assumptions upon hydraulic powers have been spread abroad, and the legislatures of the Provinces and of the Dominion have been urged, as in the case of New York State, and of the Federal Government, to pass laws dealing with the acquisition of forests and streams, and establishing commissions of legislatures for the purpose of promoting so-called "conservation."

In the Province of Ontario, public attention has been largely concentrated upon the question of making the falling waters of its rivers available for the purpose of generating power for general public uses. Such a situation was natural, as Ontario not only possessed, but has already developed and utilized a larger proportion of power in the form of falling water, than other provinces of the Dominion.

Out of a total of one million water horsepower utilized, over one-half is in use in the Province of Ontario. Of this amount, four-fifths has taken the form of the production of electrical energy, the major portion of this large aggregate being contributed by the power developments on the Canadian side of the Falls of Niagara. It was, therefore, natural that the people of this province should follow with special attention the various undertakings to utilize the force of the falling water of Niagara, since the first development was put in operation in August, 1895, and should be readily influenced to claim a share of its ostensible benefits.

The attention of the whole educated world was concentrated upon this fascinating achievement, and the possibilities which similar operations appeared to offer to the Province of Ontario, became a large factor in the establishment of the Experiment, the results of which are now to be described.

The public policy of the Province in this connection, as stated by the Commission of Conservation of Canada, "has been prompted chiefly by events connected with the development at Niagara Falls." It has accompanied an active agitation on the subject of municipal ownership and operation of public utilities, which had been in progress at the time of the first electric development of Niagara power, and which took a new form in the region near Niagara, as a result of that conspicuous event.

The incidents which led up to the Great Experiment are of interest as showing how a public movement of widespread importance may be started upon a relatively small but conspicuous achievement, which by reason of contributory circumstances, may develop into a far-reaching movement of a character such as could not have appeared practicable at the time of its first inception. As has been said, the people of Ontario, seeing the development of power in the form of electric energy upon the United States side of the Falls of Niagara, were attracted by the suggestion that the available power of Niagara belonged to equal extent to the Province of Ontario, and that its people were equally entitled to any benefits that could be derived from a utilization of its force.

From this point of view it is easy to see that a demand for cheap electric light and power would arise, and that dissatisfaction would result with services already being provided in various municipalities by corporations supplying electrical energy from steam power installations, or controlling certain of the sources of water power. Coupled as were these conceptions with the growth of the idea of municipal ownership and operation, a widespread agitation resulted.

In 1897, the City Council of Toronto, which had been active in agitating a demand for cheaper light and power, took estimates upon the cost of a plant to manufacture light and power by the city; and also called for tenders, for a supply of power, from corporations having power plants or hydro-electric developments. Application was made to the Legislature of the Province by the city for permission to enter upon municipal ownership and operation for electrical service.

Although no practical result followed immediately upon this action, public sentiment was attracted thereby to the general subject, and during the years 1901-2, civic organizations became interested and adopted resolutions advocating municipal ownership and operation of electric and other utilities. During this discussion the idea arose that a combination of municipal corporations might secure the desired legislation with greater ease than individual corporations, and out of this suggestion was developed the project of a municipal union, which agitators, principally in Ontario, advanced as a means for the defense of "the interests of citizens against the encroachments of great corporations."

This resulted in the meeting of a convention of representatives of various municipalities in which the idea of municipal ownership had taken root, at which a "union of Canadian municipalities" was organized, and under this ambitious title, proceeded to develop the movement throughout the Province.

A conference of manufacturers was then called together by those interested in promoting the subject, to discuss the question of securing power for industries at cheaper rates, and it was from this gathering that the suggestion emanated, which resulted in the Great Experiment.

These manufacturers were chiefly those engaged in business in the towns of the Niagara peninsula, and they met at the City of Berlin as a central point of mutual convenience. Their purpose was an admittedly interested one, to secure for themselves a cheap supply of energy without undertaking the burden of capital expenditure required for the purpose. Out of this situation, they developed a scheme which led to the Great Experiment, the credit of which idea must be given to Alderman Spence, of Toronto, who made the following proposal, which was approved by the manufacturers present:

"Other municipalities should ask for the appointment of a Government Commission, which "would have the power to arrange for the transmission of electricity to the various municipalities desiring it. This commission would issue "its own bonds in payment of the transmission "lines, these bonds to be covered by bonds of "the various municipalities interested, the latter "to be deposited with the Commission. The "amount of the bonds, of course, would depend "upon the power required by the various munici-"palities. Under this scheme the Government "through a commission would undertake the "transmission of electrical energy from Niagara "Falls, or any other point, to municipalities de-"siring power, the latter guaranteeing by their "bonds the cost, and selling in turn to all man-"ufacturers *at an even rate,* preventing in this "way the power from falling into the hands of "any monopoly and securing to the interests of "the Province the advantage of cheap electrical "energy."

The words italicized are significant, especially in view of the ultimate outcome.

These and other manufacturers followed up this subject by organizing a meeting in the same city in 1903, at which about eighty municipal representatives met the manufacturers and other business men, and were influenced to recommend that power should be sought from the Legislature to enable their municipalities to undertake the work of developing, or of purchasing and distributing electrical energy. At this meeting a prominent part was taken by a manufacturer then acting as Mayor of the City of London, Ontario, who was destined thereafter to become one of the leading factors and eventually to become the main force in the Great Experiment.

An Act was then passed by the Legislature, providing powers for the construction of municipal electrical power developments and systems of transmission and distribution; but this concession did not satisfy those who were now promoting the scheme of governmental operation, involving the credit of the Province in the distribution of power for manufacturing purposes. Several municipalities, under the authority of this Act, combined in the appointment of a Commission under the title of the Ontario Power Commission, which included in its membership Mr. Adam Beck, of London, and Mr. P. W. Ellis, who was one of the Commissioners of Victoria Park, Niagara.

At this juncture a provincial election occurred, which resulted in a complete change of the political complexion of the government of the Province, and brought into power, as Premier, Sir James P. Whitney, the present tenant of that office. In the course of this political change, the subject of water powers was publicly discussed, and, seeing in it an opportunity of popular support, some of the candidates pronounced in favor of governmental action in connection with water powers, among them being Sir James Whitney, who expressed his views on taking office in the following generalization:

"The water power at Niagara should be as "free as air, and, more than that, I say on behalf "of the Government, that water powers all over "this country shall not in future be made the "sport and prey of capitalists, and shall not be "treated as anything else but a valuable asset of "the people of Ontario, whose trustees the gov- "ernment of this people are."

This elastic assertion ignored the fact that water power is limited by location, by character and quantity, while air is not, and that the water powers all over the country are not under the control of the government of one Province, but are partly international, and that these water powers have been, to a great extent, developed for the benefit of the community in the establishment of special industries and the production of material wealth, by investments made by the people of the Province. Such as it was, however, the statement was little different in character from many of the indefinite assertions used to affect public sentiment at this time, and the Government proceeded in its first step, confident of the approval of a majority of the voters.

This step was the establishment in 1905, of a Commission of Inquiry to report upon the subject of hydraulic electric power in the Province. Had such a commission been appointed with a view to an impartial and serious consideration of all sides of this great question, and armed with knowledge to appreciate its technical elements, it is probable that the people of the Province of Ontario would have received an enlightenment upon this whole subject, which might have modified advantageously the course and developments of the experiment.

The Commission as constituted, however, comprised Messrs. Adam Beck, George Patteson and P. W. Ellis. Two of these were local manufacturers of the number of those engaged in promoting the scheme, and none of them were qualified by experience or training to apprehend the technical features included in such an enquiry, which involved "the ascertainment of present and probable demands for power, the location, capacity and cost of developments of such powers, and of transmission plants; also the rates and prices required to be charged, by a Government plant."

The members of the Commission thus appointed were among those who had been prominent in the agitation to involve the province in providing the funds for the supply of cheap electrical energy to manufacturers. Two of them were, in point of fact, engaged in such business; and there was little probability, in view of these circumstances, that any other result than recommendations in one direction would materialize from their inquiry. While the Commission was yet engaged in its investigations, its Chairman was visiting various municipalities in the Province, making public addresses in favor of cheap power, and outlining a power policy to be adopted or followed by the Government. In this manner, so prominent did this member of the Commission become, and so popular his presentations, that he was invited to join the Government as a member of the Cabinet, though without a portfolio, a step which greatly added to his influence in the municipalities, and secured for him the most prominent position in any developments which might follow.

As a result of his active exertions and ingenious public assertions, reinforced by his official position upon the Commission, representatives of a number of municipalities came together in a conference with the Premier and his colleagues, at which they presented a resolution urging the Government to adopt legislation for the purpose of appointing a permanent provincial commission with power to take action "where considered by it advisable" in the following directions:

"The construction, purchase or expropriation "of works for the generation, transmission and "distribution of electric power or light, to ar-"range with any existing development company "or companies for power at a reasonable price, "so as to be transmitted and sold by the govern-

"ment to municipalities or others, *also to vest in* "*it the powers necessary to enable it to regulate* "*the price* at which electricity shall be sold to all "and every consumer, whether municipal, cor- "porate or private."

Again the italicized phrase is significant in view of the eventual developments.

The influence thus brought to bear within and without the circle of the Cabinet, resulted in the passage of the measure known as "6 Edward VII, Chapter 15, an Act to provide for the transmission of electrical power to municipalities —approved 14 May, 1906, and providing for the appointment of the HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO."

Thus came into existence the Great Experiment, and on the 7th of June, 1906, the composition of its membership was decided and the Hon. Adam Beck, as its Chairman, took the lead in the promotion of its action and methods, which he has continued to the present time.

Armed with the ability to expend the funds of the Province, the Commission was now in a position to meet the demand for a supply of cheap

NIAGARA.

The People's Heritage.

power by use of public credit. It is noticeable that up to the time when Mr. Beck commenced his public addresses upon the subject, little or nothing had been said of any need or desire on the part of the general public not engaged in manufacture or business, for cheaper electrical service, but he seized upon this feature and made a popular use of it in his addresses. It is undoubtedly upon this phase of the matter that popular approval of the Experiment has been so far formed, but it must be noted in this connection that the decision to embark a municipality in the scheme of municipal ownership and operation is not decided in Ontario by popular vote, but by the vote of ratepayers. General opinion upon this subject has only been expressed so far in the election of the government of the Province, which did not make this subject an essential feature of its demand for the support of the community, but developed it after election.

The Hydro-Electric Power Commission proceeded to negotiate with municipalities in the Niagara Peninsula, and brought together in the end of 1906 a conference of municipal delegates at Berlin, which resulted in the endorsement of the scheme of operations of the Commission, which had little practical result so far, but asked for the promotion of further legislation, giving greater scope and powers to the Hydro-Electric Power Commission.

Under ensuing legislation, the Commission was armed with power to "acquire by purchase, "lease or otherwise, or without the consent of "the owners thereof or persons interested "therein, to enter upon, take and use the lines, "waters, water privileges, water powers, works, "machinery and plant of any corporation or per-"son owning, holding under lease or otherwise "or developing, operating or using the same for "generating or adapted for generating electrical "power or energy or for the transmission thereof "in Ontario, and to develop and use the same for "any of the purposes of this Act."

At this time, many municipalities had already passed by-laws authorizing their municipal councils to contract with the Commission for a supply of electrical energy, and so the Commission entered into an agreement for a supply of power with the Ontario Power Company of Niagara Falls. It is rather interesting to note that this Company, which was one of those organized to develop electrical energy on the Canadian side of Niagara Falls, had constructed an enormous development of a capacity in excess of any then requirements for its output, except by the establishment of new industries in its vicinity or by the transmission of the energy developed to the United States side of the Falls.

Great efforts were being made at that time by those interested in such developments, to secure the sale of their surplus output in the United States, a course which directed public attention to the subject and resulted in the limitation of the amount of energy, manufactured in Canada, permitted to be absorbed in the United States. Placed thus in a position in which the possibilities of production exceeded those of utilization, power corporations upon the Canadian side were compelled to look elsewhere for consumers of the energy which they were capable of producing.

At this juncture, fortunately, the Hydro-Electric Power Commission came into being and provided a handy consumer ready to expend unlimited capital upon transmission lines to distant consumers, the cost of this work being now cast upon the people of the Province. It was at least an extraordinary combination of circumstances which thus brought the people of the Province to the rescue of the Niagara power developments and relieved them of the necessity of spending their capital in reaching consumers of their product.

Not all of the property owners and business men in the municipalities of the Niagara Peninsula were convinced of the desirability of the course of the Government and of their municipalities in this direction, and some opposition developed to the action of the municipalities in contracting with the Hydro-Electric Power Commission for energy.

In 1908, some of these objections had taken pronounced form, and it seemed probable that the municipalities would be prevented by court action from entering into such contracts. In order to dispose of this opposition, at the instance of the Power Commission, the Legislature, in 1909, adopted another Act, which swept away not only from the objectors to the scheme, but also from the people at large, the protection of the courts of law, by one of the most extraordinary legislative provisions which has ever been adopted in any free country. This Act, known as "19 Edward VII, Chapter 19," not only validated certain contracts which had not received the assent of certain municipalities, but expressly enacted that any action which should call in question the jurisdiction of the Commission in this and other matters, "shall be and the same is "hereby forever stayed." Thus no legal remedy remains for any ratepayer or other person, as against any action taken under the authority of the Hydro-Electric Power Commission of Ontario, the Chairman of which thus became the Dictator of the Province in the matter of the Great Experiment.

The climax of this situation was reached in 1911, in an Act known as "I. George V, Chapter 14," which placed it in the power of a single ratepayer to involve his municipality in the expense of an electrical system, without a vote upon the subject, in the following ingenious manner: "Any one or more of ratepayers in a municipal-"ity, the corporation of which has not entered "into a contract with the Commission under the "Power Commission Act, may apply to the cor-"poration to obtain from the Commission a sup-"ply of electrical power or energy for the use of "such ratepayer or ratepayers for the lighting, "heating and power purposes or for any such "purposes." . . . "The Corporation with-"out submitting the same to a vote of the rate-"payers and without any of the other formali-"ties required in the case of a by-law passed un-"der the Power Commission Act, may pass a by-"law for entering into a contract with the Com-"mission for a supply of electrical power or en-"ergy required by the applicants, and may enter "into a contract with the Commission for that "purpose."

In the same bill, the following addition was made to the already plenary powers of the Hydro-Electric Power Commission: "Nothing "done by the Commission within its jurisdiction "shall be open to question or review in any action or proceeding or by any court."

This Great Experiment, therefore, finally developed into the establishment of a Commission to which the Legislature has delegated power to embark in the business of electric generation and distribution, without power of regulation of existing rates for such services, but with almost absolute power over the rights, privileges and personal property of a large portion of the population, with a complete withdrawal of any protection afforded by the courts, which, in the absence of constitutional provisions in Canada, left not only the property of many persons but the expenditures of the taxpayers at the mercy of the members of the Hydro-Electric Power Commission.

CHAPTER II.

THE VIEWS OF THE COMMISSION.

IN New York State, the same subject has pursued a different course. The Legislature has developed its policy of "conservation" from the protection of fish and game, into the protection of forest reserves, and thence into the field of protection of water sources. The State Conservation Commission, which has gradually become charged with all these subjects, has, for the past two years, actively promoted a scheme for governmental ownership as well as the development of water powers, and in 1911, fostered a proposal to arm itself with powers similar to that of the Ontario Commission. The proposal met with inherent difficulties in the existence of a constitutional protection of property, and in the fact that the system of regulation of public service utilities is already established.

The Legislature appointed a Committee of Enquiry into the whole subject in 1911, which, among other matters, received a statement from the Chairman of the Ontario Commission describing his views on the establishment of the Hydro-Electric Power Commission. Following its report, in the early part of 1912, proposed legislation was delayed and the Committee was continued, chiefly in order that a more complete and exhaustive enquiry might be made into the workings of the Ontario system, and as a result, this Committee, during the year 1912, made a number of visits to Canada, and received a variety of testimony, collected a large amount of statistical and financial data, and have made a report thereon in January, 1913, to the Legislature of the State of New York.

In giving testimony before the New York State Legislative Committee, the Chairman of the Hydro-Electric Power Commission of the Province of Ontario gave his own account of the organization, of the agitation and growth of public interest in this matter, which led to the establishment of the Commission.

After briefly describing the preparatory steps which led up to the appointment of the first Municipal Commission, he stated that the report of this Commission "was submitted to the people, "showing the great saving it would mean, the "great value to our industries, even to small "householders, because of its cheapness, making "electricity available to villages and small com- "munities, the supplying of which corporations "would never consider." It was just such generalizations as this which led the public to support the experiment.

"There came a change of government at this "time," he added, "and I happened to be elected "a member of the Legislature and was taken "into the Cabinet without portfolio by Sir James "Whitney. Having been identified with the "Commission, the Premier asked me to form a "plan and devise a scheme, and lay it before the "House, which would meet the demands and re- "quirements of the municipalities." Mr. Beck did not refer to the manufacturers as the originators of the scheme, but said:

"The fundamental principles of the scheme "are simply these, that the government under- "takes to finance the whole scheme and appoints "a commission to operate the scheme as a whole. "There were two difficulties in the way, first, co-"operation would not be complete. Supposing "the municipalities appointed a commission, the "larger towns would probably outvote the "smaller, and it would be gradually merged into "the larger interests, or larger communities; the "smaller would not be considered, and the larger "ones would dominate. Then again the finan-"cial undertaking might be very large. If you "went to develop and transmit, the cost would "soon run up to twenty or twenty-five million "dollars. That was rather a serious matter for "municipalities." It did not seem to occur to him, that the people make the municipalities, and both together make the province, whose credit is that of the whole.

"An Act was passed which is considered the "most drastic legislation which was ever passed "by a legislature. We were given power to ap-"propriate the water, lands, machinery, build-"ings and apparatus of any kind or nature for "the purpose of generating and transforming "power and transmitting the same. We could "appropriate the lands and transmission lines "of any corporation, and last but not least, we "could take the product of any plant." And he might have added that all this can be done without the consent of the owners, or of those who had loaned money upon the properties.

"At the first reading, we were given the power "to regulate the electric and gas rates of any "corporation or company, but there was such a "storm of protest on account of the rights of "gas and electrical companies, that when the bill "was given a second reading these words were "eliminated, which meant that we had only power "to regulate the rates of municipalities that we "supplied with power." The storm was due to the inclusion of these powers with those of an appropriation of property, making the judges of rates practical dictators and autocrats.

"There is a clause in the act preventing power "being used for bonusing. A municipality could "not offer power below cost to secure an indus-"try from another municipality." But no effort seems to have been made to prevent some from doing this very thing.

"We cannot sell electricity below cost. It was "not the theory to make money for the Province; "there is no revenue to the State whatever. The "effect of cutting out power to regulate rates was "that we had no redress, no ways and means of "checking exorbitant charges for electricity ex-"cept by going into a direct competition with "the existing company." He might have added that by abandoning the competitive scheme, the power of regulation might have been secured, but the former was more attractive to those who were anxious to get the benefit of low rates for power at public expense.

In speaking of the subject of securing power at Niagara, the Chairman referred to the opposition to the proposal that the Commission should construct developments at Niagara Falls, and referred also to the agreement made by the Niagara Falls Park Commission, with its lessees, that it would not generate power other than for the purpose of lighting the park. This commission, being a provincial government institution, had practically pledged the provincial government not to enter into direct competitive construction with the water power developments on the Canadian side, and therefore he stated that —"we, as a government required to keep faith "with these interests," although it was not their view that where franchises had been granted to companies, the same good faith was desirable to protect their value.

So they undertook to secure power by purchase, rather than to develop it or to use any of the drastic measures at their command.

Out of the existing developments the commission received bids from only two corporations—The Ontario Power Company, and the Canadian-Niagara Power Company. The offer of the former was accepted, and a contract was entered into for a minimum quantity of 8,000 horsepower and maximum of 100,000 horsepower. Remember that this was one of the new developments which had been seeking customers all the time of the agitation.

Mr. Beck then described the consideration of and the decision to construct a high-tension transmission system from Niagara Falls, the length of which at the time was in the nature of an experiment, and said that the Commission considered that the public was justified in undertaking an experiment of that kind—"that it "was for the general good of the Province be- "cause we were progressive enough to feel that "if we should do something for our own people, "it might be of some value to the people of the "whole world;" an experiment within an experiment, both at the public risk.

He admitted that this decision involved a larger capital investment in the apparatus for transformation because of the unusually high tension of the system, and then described the financial side of the undertaking, as follows:

"The government borrows the money by issu- "ing Provincial bonds at 4 per cent. interest, "with a sinking fund to retire the indebtedness "in thirty years. We have changed that since. "We felt that the first four or five years, when "there was a great amount of construction going "on, when the municipalities would be working "up their load, their business and customers, "they should not be asked to pay anything to- "wards retiring the debt, until 1914, making it "in twenty-five payments instead of thirty. The "result is that instead of a 1.8% sinking fund, it "will be 2.4%. Another reason was that the mu-"nicipalities would continue coming in the first "five years, more so than afterwards. The larger "municipalities might want to dictate and argue, "and until they compensate us for the monies "already invested, we do not think they should "come in." But it is noticeable that some have been allowed to do so. "Before an additional "municipality comes in, we, under the act, con-"fer with them, hear them, but we reserve to our-"selves the right to say whether the municipality "shall be admitted or not; we do not leave that "to the other municipalities. At any rate, until "1914, they may come in on an equal basis, and "no one will have paid anything towards the re-"tiring of the debt." It will be all shoulders to the wheel thereafter.

In answer to a further question as to the reason for the issue of bonds at thirty years date, the Chairman stated:

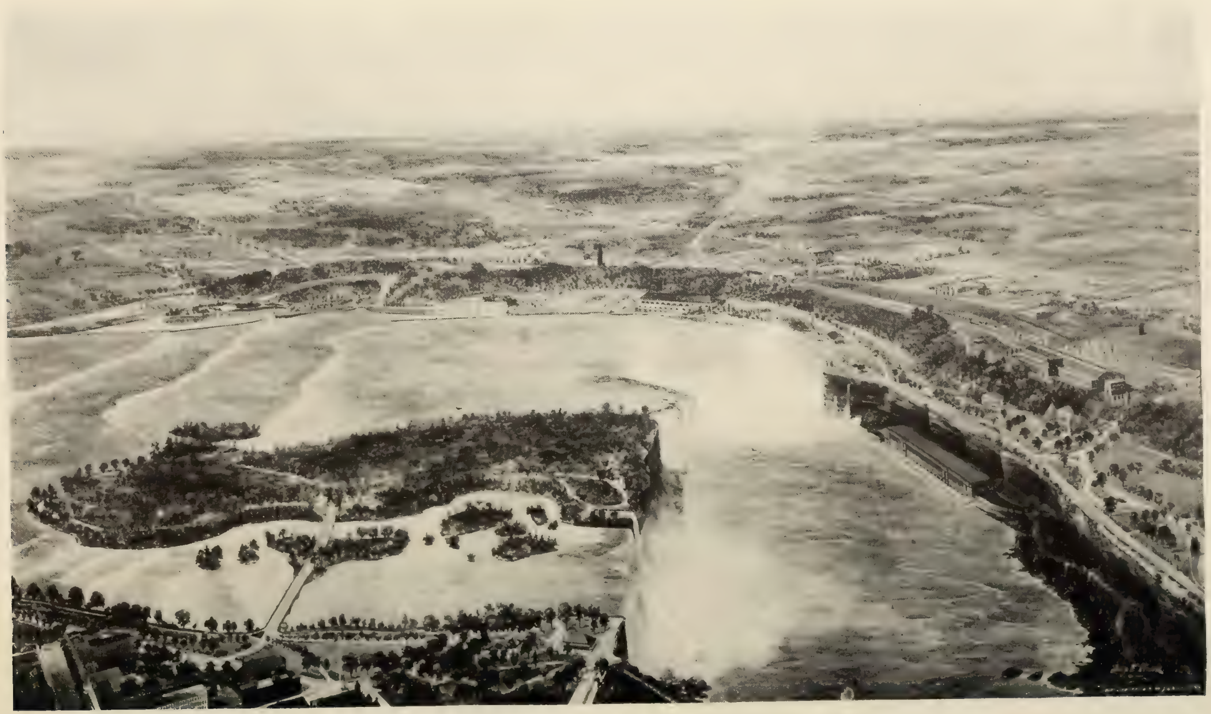
"We thought that in thirty years the art of "transmission, I mean the art of electricity may "advance so that the whole project may become "obsolete by that time, but to provide against "that we add from three to four per cent. for "depreciation to the cost of power." But no such provision has been made so far. "The cost is "made up as follows: Interest, 4 per cent.; "sinking fund, 1.8; maintenance, 1½ per cent.; "the depreciation depends upon whether it is low "voltage wooden construction or the steel tower, "running from two to five per cent.; then operation, administration and line loss." Here then is the Chairman's summary of the elements composing the cost of power on which neither profit nor loss is to be made. It may be compared with the financial conditions later on.

"The Province paid for the engineering cost "when the first report was made. As to the cost "of the commission, we have an appropriation "from the Province of fifty to sixty thousand "dollars a year, which the Commission uses to "report to the Province, and to the municipalities, to make estimates and report upon the "water-powers of the Province as a whole, that "is, such work as we think is of general value to "the whole province." This is work which is already done in great part by the Conservation Commission of Canada. The Commission budget for 1912 involved $276,000, including the above appropriation.

In reference to the construction of hydro-electric power developments, he said that—

"We felt that it would be just as well to go "into the open market and patronize the gen-"erating plants that were established there, hav-"ing a surplus of power available," such as the Ontario Power Company, "and that it would "be folly to make another large investment to "generate power for our own use, especially as "we considered that we had obtained a fair price, "and had an exceptionally fair contract."

"The idea was not to build a cheaply con-"structed line or apparatus with a view to a "small investment and a large possible dividend "for fictitious values, commonly known as wat-"ered stock. Our purpose was to have only the "very best and the most efficient that could be "built." What is the difference between such a



The Ontario Side of Niagara and the Power Developments.

process and watering stock, as regards the ultimate capital cost?

The Commission had to decide whether to buy land for right of way or not, and decided against it.

"In buying the land as the railway does, you "can arrive at the value of the land, but in buy-"ing an easement it is absolutely impossible. The "consequence was that while we had $220,000 in "our estimates, the right of way cost nearly half "a million dollars, and it is the only item in our "undertaking that exceeded the estimates." Its total exceeded $542,000, and by the time the sinking fund has paid off the cost, it will have to be bought all over again.

"We now have an easement for thirty years, "and if we had bought the right of way, we "would have had the right over the land for all time." But if it had been bought, the cost of power would have been considerably enhanced.

As the interest was charged to capital account, only the operation cost and cost of power were charged to municipalities. Up to November, 1911, the Commission had only paid for the actual cost of power, and operation, but not for maintenance nor sinking fund, nor even interest. Yet the prices given to the municipalities, he asserted—"provided for maintenance, interest, op- "eration and line losses, in fact, everything ex- "cept sinking fund, and depreciation."

In speaking of the policy of entering into parallel construction and competition with existing electrical systems, he said—

"We have been called unfair in not buying "out local companies or compelling the munici- "palities to buy local companies. Companies hav- "ing exclusive franchises have rights, but where "a company has not an exclusive right the mu- "nicipality is entitled to go into business without "buying out the company." The measure of fair treatment therefore in the eye of the speaker was evidently the exclusiveness of a franchise.

"The prime object," added Mr. Beck, "of the "whole scheme is not only that the government "shall deliver this power at cost to the munici- "pality, but that the consumer shall have it at "the lowest possible cost, making ample provi- "sion for the redemption of the whole debt in "thirty years." The method of redemption which has been followed was to suspend it.

"It is not intended that a municipality should "have a surplus and use it in the reduction of "their tax rate." Yet this is what several expected to do, and actually tried to do, as at London.

Being asked as to the effect upon the rates or prices of competing companies, the Chairman stated that he believed these companies knew the Commission would not sell below cost "and that "there must be ample revenue to provide for de-"preciation." But no such provision has been made or earned, yet in spite of the fact there have been recent reductions in the rates for power.

He claimed, however, that the competing companies had advantages in the control or interest in other industries, for using their output. That the Commission did not want to do anything to injure private interests or vested rights, admitting that the bonds of private companies are largely held by the investing public. He did not explain that competition, based on bare costs, without the charges he himself described as "included," was at the time in operation, and that Companies are still compelled to pay taxes, while competing with the government and municipality. The impression left by these statements is that of a very lame apology for the principles of the Experiment.

CHAPTER III.

"CONSERVATION" OF WATER POWER.

THE sight and sound of a vast body of falling water naturally lead the reflective mind to a consideration of its latent forces. To those who have had the opportunity of examining some of the wonderful natural features of the great water-falls of the country in their varying conditions of flow, such consideration has been modified by the evident variety in the volume of water-falls and in the equally evident physical difficulties accompanying the so-called "harnessing" of water-falls; conditions which lessen very considerably the apparently attractive possibilities of their utilization. But in a country such as the Province of Ontario, in which such waterfalls abound, it is natural that its citizens should, as they read or are informed of the immense water areas and volumes of falls which extend throughout its vast boundaries, become deeply interested in the question of their possible utilization. So far as their commercial value is concerned, a modifying consideration should have accompanied that interest, and the people should have been reminded that, although deprived of coal, Ontario is proving rich in oil and natural gas, and possesses some of the most immense peat beds on the continent. Such resources with which nature has endowed the country, are direct competitors of the water power which has taken so prominent a position in the minds of its people.

It would be well for those who have been attracted by the spectacular feature of this subject, to weigh carefully its value and natural and economic limitations.

The flow and the fall of water is only one part of the result of the precipitation of moisture upon the surface of the earth, which process follows great natural laws and great movements and changes of the atmosphere, but upon which is dependent not merely the running water which has so striking an effect upon the senses, but the vastly greater element of fertility of the soil and of re-precipitation by the process of evaporation. Of the entire rainfall, more than one-half is re-evaporated into the atmosphere, and of the remainder only two-thirds forms the visible run-off or water held in lakes and in motion in rivers and falls. The residue is that important portion which enters the surface soil and maintains a vast body of ground water lying below and constituting the main source of fertility of the soil.

Any interference by the operations of man, with the surface conditions, in which must be included alterations of the run-off and of the position and levels of stored water, may, and does in many instances, adversely affect the maintenance of the level of the ground water, with a consequent reduction in the capabilities of the soil in the production of crops, upon which the prosperity of the country depends.

It is possible, by the expenditure of labor and capital, so to divert or change water-courses in the form of rivers and falls, and water-storages in the form of lakes and marshes, as to affect adversely great areas of cultivatable land, with resulting enormous indirect damage.

The protection of the underground waters is therefore beginning to be appreciated as the first and most important problem connected with this subject, and legislative action has already been taken in certain of the western States, inflicting penalties for such local action as has, or is likely to have an effect in reducing the level of the ground water. It must be evident that this supply, which is dependent upon the smaller proportion of the total distributed precipitation, is also considerably dependent upon the levels of streams and the flows of rivers, and the maintenance of natural storage water levels, which, through underground sources, have an effect in maintaining the underground supply in addition to the precipitation soaking in from the surface. The subject must in future be accorded primary consideration in any proposed utilization of run-off or surface waters. There is another feature of the same subject to which the largest proportion of literature and agitation has been devoted, namely, the effects of de-forestation upon the productive character of extensive areas not immediately contiguous to the scene of such destruction. But such de-forestation is largely contributed to by the damming back of water for the purpose of power developments, a source of injury as destructive as fires, as regards the removal of the timber, but much more permanent in its effect. There is abundant material available as to the injuries already inflicted by such processes, some of which appear under the guise of conservation, and some evidence as to the injuries resulting to the ground water system therefrom, all of which indicates that the attractive utilization of water power, accompanied as it usually is by the flooding of certain areas for the purpose of storage, is capable of inflicting injury of widespread extent, exceeding the apparent commercial value.

Another point of widespread importance is that of the maintenance of navigable depths of water in streams which form the great water highways of the western world, and which constitute an element of vast importance in the natural wealth of its communities.

These considerations all indicate that the national interests are bound up to a much greater extent in the proper preservation of the water in its natural conditions, than in its commercial development, which constitutes the least and last of the desirable forms of "conservation." It is therefore desirable that those who have been influenced into public action, or who are being incited by enthusiasts to adopt their opinions and support policies for the so-called conservation of water powers, should realize the relation which this, the minor phase of the subject, bears to the more vital and larger elements, and it is further desirable that those who are not technically informed upon the mechanical limitations of power developments at waterfalls, should understand that these exist, and that the great volumes of water which are to be seen at certain seasons of the year, passing over some magnificent fall or rapid, are not in their entirety available for the purposes frequently assumed.

Such considerations indicate that protective national regulation, as opposed to mere local or even State regulation, is desirable in connection with the whole subject of conservation of waters, and it does not follow that such protection is to be interpreted into the desirability of dealing with such natural elements in a mechanical manner, but that there may be, and generally are, other elements which are equally if not more desirable in the general interests of the population of the whole country. If, for instance, the diversion of water from one natural position to some other line of distribution, should bring about a change in underground conditions, it might be that the commercial advantage of the development would be far outweighed by damage done at a considerable distance from the locality, possibly in some other area of government.

The prevalent idea that immense areas of water in the form of lakes, streams and rivers, afford a corresponding amount of water power, is also erroneous and misleading. Statistics and maps showing areas under water in any country afford only one element of information upon the question. There are, for instance, enormous bodies of water in Canada, the shallowness of which is such that the total volume impounded is insignificant compared with lesser watered areas. But the maintenance of the surface of these shallow waters is of great importance on account of their evaporative capacity and of their effect upon infiltration to the ground-water levels. It is more than desirable, therefore, that the public should not be misled by mere assertions as to the extent, availability and value of water powers, much of which can only be utilized by extensive interference with the processes of nature.

The availability of any given fall of water for the purpose of power developments is, as has been said, always less than that which appears from a casual inspection.

The effects of rainfall, of natural storage, of changes brought about by de-forestation, the presence of ice and variations in temperature, are all productive of variations in flow, only the minimum of which is useful for effective development. It therefore follows that many of the figures quoted for public absorption as to enormous available powers in water-falls in Canada and the United States, are subject under actual conditions, to very large discount. Thus estimates which have been published as to the availability in Canada of upwards of seventeen millions of water horsepower, are authoritatively stated by the Commission of Conservation, to rest upon no proper or reliable basis.

It is probable that out of this exaggerated figure, about one-eighth of the total would represent the maximum commercially available. The more this subject is studied and the more information is secured as to the varying conditions affecting the flow of water, the more restrictions appear in the utilization of falls of water.

As Dr. Henry Wallace, one of the most practical advocates of true conservation, recently stated:

"Conservation means rational use."

The chief danger of the present enthusiasm in respect of water power conservation lies in its irrational assumptions. To be dealt with suitably, such problems are not effectively covered by any local or state form of administration, and require to be dealt with by a nation-wide system.

The study of Niagara by the two nations is an effective illustration in point, since it has brought out facts connected not merely with the local value of water powers, but the far-reaching effects upon the level of water in the vast lake system, the limitations derivable from which are likely to be paramount in future international dealings with the subject.

In examining the statements which have been made by those specially engaged upon the developments of the Hydro-Electric Power Commission system in Ontario, particularly those of its Chairman and his associates, it is observable that the principles by which they appear to have been actuated in guiding public opinion and in deciding upon their present operations, are similar to those which are to be met with in general references, and are subject to the same lack of full consideration and information upon the subject which prevails in the common discussion of these matters.

The particular consideration upon which they lay stress and by which apparently their purposes have been guided, is that the Province of

Ontario is destitute of a natural supply of fuel, but is abundantly supplied by nature with waterfalls; and that the offices of the government, established in and exercised through the Hydro-Electric Power Commission, are bringing to the people of the Province of Ontario cheap power in the form of generated and transmitted electrical energy, thereby benefitting the people of the Province by a supply of force attractive to industrial establishments, and contributing to the welfare of its people.

Giving full credit for good intentions upon which the action of these persons may have been based, it is not possible to accept these considerations without considerable limitations, to some of which attention has already been drawn.

The view seems also to prevail that the power thus developed, is the proper and most desirable use of a national resource, and that in the course of time the whole of such available water powers may be developed into power plants and the resulting energy transmitted in the form of electrical force throughout the Province.

But as a matter of actual dollars and cents, the commercial value of the scenic or aesthetic features of such a development of natural forces, is in certain instances in excess of the value of such power as can be practically developed from the falling water into energy commercially utilizable. This view has so far found practical acceptance on the part of the peoples of the United States and of Canada, and is already established in the treaty between the two countries, by which the further abstraction of water from Niagara Falls for power developments has been limited. It is evident that any governmental utilization of the water for the production of energy may be no less objectionable than is its utilization by private corporations.

The commercial value of the aesthetic character of Niagara was estimated by the engineers of the International Waterways Commission, as productive of an annual revenue by visitors and travelers, to channels of general trade, amounting to at least twenty millions of dollars per annum, or a capitalized value of Four hundred millions of dollars. This view is maintained by various public bodies, among which is the American Civic Association, which, in a statement published in 1911, says: "The value of Niagara "Falls to the people of the United States in simple dollars and cents, is far greater as a spectacle to attract travel than as a source of water "power."

It is probable, in the view of many of those who have studied the subject, that the time is not far distant when the real value of the Falls under their natural conditions will be so completely recognized, that the whole of the existing commercial developments will be removed and the Falls restored to their original condition. Such a step in spite of the large accompanying cost, may become practical, not only by reason of the enhanced value of the Falls from a spectacular standpoint, but even from a commercial standpoint, by the increased value of the water abstracted when utilized in a position where the full head of Rapids and Falls can be secured, thus making a larger and better use of the restricted amounts which should be devoted to such commercial purposes.

The American Scenic & Historic Preservation

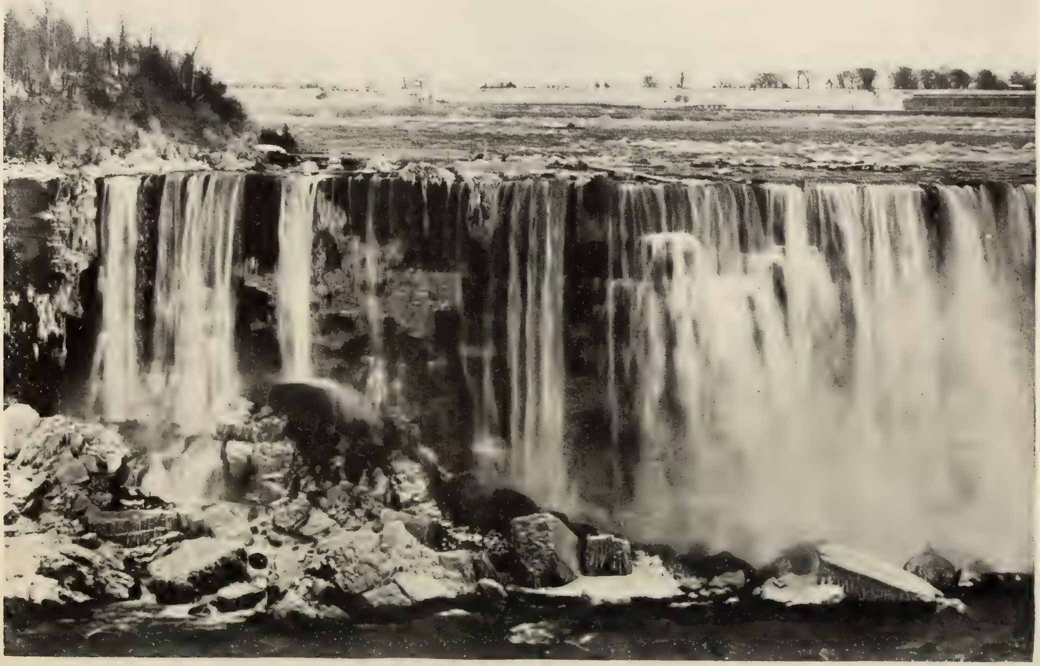
Society has prepared a statement showing the effect upon the appearance of Niagara, of the withdrawal of water above the Falls for the present American and Canadian power plants. These figures show that of the normal discharge of Lake Erie into the Niagara River of 210,000 cubic feet a second, the American companies derive 7.19 per cent., and the Canadian companies 5.24 per cent., reducing the volume of the falls 12.43 per cent. Under these conditions, the length of the crest of the American fall is 1,035 feet and that of the Canadian fall, 2,450 feet. If the total diversions made permissible by the International treaty, should be authorized and utilized, then these amounts derived from the Falls would be increased, and the American companies would take 9.29 per cent. of the total flow and the Canadian companies, 17.14 per cent., making a total reduction in the volume of the Falls, of over one-fourth of all the water normally capable of passing over the falls. The effect upon the appearance of the falls, and especially of the Canadian Fall, would then be very marked, as the depth being reduced, would lay bare about 200 feet of the crest. There would also be periods of the year when the volume of flow of the Niagara River would be reduced to low water conditions, which have been well established by observation, at which periods the foregoing conditions would be aggravated very considerably and the reduction of the volume of the falls by the diversion of the water for commercial purposes, would then amount to one-half of the total.

Under such conditions, the American Fall would be curtailed in width, and the Horseshoe Fall would lose nearly 800 feet in width, or one-third of its crest would be dry.

Upon these facts there can be no more forcible or authoritative opinion than that of the Chief Engineer of the United States Army, Major Charles Keller, who was delegated to investigate and report upon the subject in 1908, and whose conclusions were transmitted to Congress by President Taft in August, 1911. He says:

"The extremely low water of 1895 was due to "natural causes, and such a deficiency in pre-"cipitation is sure to recur. When this happens, "Lake Erie, if still in its natural and unre- "stricted state, will be lowered approximately "two feet below the summer elevations of 1907 "and 1908. Nature will then reduce the height "of the sheet flowing over the American Fall by "over three inches and that over the west end of "the Canadian Fall by over 14 inches, while the "water at Terrapin Point will be lowered by 5½ "inches. These natural changes, added to those "produced by existing authorized diversions, will "lower the crest at the west end of the Canadian "Fall nearly 2 feet and at Terrapin Point over "8 inches. As a result many shallow places at "both ends of the Horseshoe Fall will become "dry. Thus natural changes upon those pro- "duced by man, will result in a mutilated Niag- "ara, one shorn of nearly half of its flow and of "much more than one-half of its natural beauty, "since many places now overflowed will be made "bare, the crest line broken, and unity of effect "will be seriously disturbed."

"The losses due to the operation of natural "laws, though largely avoidable, are perhaps "bearable; but this is not true of those due to the



The Effect, in Part, of the Expensive Experiment on the Canadian Falls.

"work of man, and in consequence I am forced "to state that existing diversions have already "seriously interfered with and injured the scenic "grandeur of Niagara Falls at the Horseshoe, "and that this injury and interference will prob-"ably soon be emphasized by the effects due to "the prevalence of lower stages on Lake Erie "and the upper Lakes."

Against such serious and carefully informed statements may be contrasted the extraordinary and radical views of those to whom the development of water powers is a matter only of commercial utilization such as that of the present Conservation Commission of the State of New York, as represented by its Engineer, who in a recent article suggested "the storage of the water "flowing over the Falls at night, in order that "it might be used for scenic effect during the day, "and power as required."

Just how many visitors and travelers would go to see Niagara under such conditions, he fails to estimate.

While these points are especially noticeable in the case of the Falls of Niagara, they are to a lesser extent applicable to the cases of other water-falls, in whole or in part. The fact that a fall of such magnificent proportions as the Kakabeka, is at present remote from lines of travel and is unknown to a large majority of travelers, is only a temporary condition, and as time proceeds, the aesthetic value from a commercial standpoint, of such natural scenes must largely increase. In the instance named, the falls are only about twenty miles from the cities of Port Arthur and Fort William, which are at present engaged in an effort to secure summer travel and visitors, to which class of people the scenery of the falls would undoubtedly prove the major attraction.

The joint International Waterways Commission in 1910 reported that "no work of man ap-"proached or ever will approach the perfection "of balance of nature's regulation of the flow of "water from the Great Lakes, though man may "disturb it," and the Conservation Commission of Canada adds that the preservation of this natural condition is a matter for international concern, and one in which the public should have an intelligent appreciation of the menace that exists in unduly utilizing the waters of the Great Lakes system, whether at Niagara, the Long Sault rapids, Cedar Rapids or elsewhere, for purposes of power development.

"The time is coming," it adds, "when people "will see that the amount of water which may be "diverted for power purposes without proving to "be a serious menace to nature's balancing of the "levels of the Great Lakes, is much smaller than "is popularly supposed."

Not only is this the case, but the exaggerated values attached to this great waterfall as a source of power, are widespread, and even so great a scientist as Lord Kelvin seems to have allowed his imagination to run away with his judgment, and to have expressed himself upon the so-called economic waste of energy, in terms which evidence an absence of consideration of the details of the subject.

The value of Niagara as a scenic place has been already established by the official investigators of the U. S. Government, at twenty millions of dollars annually. It may be well to compare with this its value in terms of power production.

The average utilized head is about 175 feet, which is that of the Ontario Power Company, now supplying the energy distributed by the Hydro-Electric Power Commission.

Under these conditions, 3.17 cubic feet of water per minute represents a water-horsepower. An annual water h. p., that is, the force of a horsepower continuously exerted, would therefore require the diversion of 1,666,152 cubic feet per year.

Generated into electricity, the water power represents only about one-half of its value, in terms of electric horsepower, so that for one electrical horsepower transmitted, 3,332,000 cubic feet per year would be required.

The normal flow of Niagara is 210,000 cubic feet per second, or 6,622,560 millions of cubic feet per annum.

This amount, therefore, represents, if it should be possible or practical to divert the whole stream, a maximum of four millions of water horsepower or two millions of electric horsepower generated and transmitted.

The revenue derivable by the State and Province at present rates, some of which are already fixed for a long period of years, is approximately $1 per electric horsepower per annum, so that the total annual value of Niagara in rents for power would be only $2,000,000.

But the real value of the product must be measured by its competition with other sources of energy, and coal is the most prominent of these sources. The transmitted energy is utilizable only in part, and for only part of the whole year, so that the net result in the form of distributed electric energy is approximately but one quarter of the water power. Thus the entire force of Niagara only results in the distribution of about one million horsepower, which could be effected for approximately 3 7-10 tons of coal per h. p., which at $3 per ton, is worth $11,000,000.

To effect this utilization would require the investment for development, transmission and distribution systems, of about $400 per electric horsepower, or about 800 millions of dollars.

The interest and fixed charges on such a sum would amount to $86,400,000 per annum, which upon a delivered output of one million horsepower, would be eighty-six dollars per horsepower, which is in excess of the cost of steam generated power.

The complete commercial utilization of the Falls is therefore found to be unpractical from a financial standpoint.

It represents only one million electric horsepower of utilizable effect.

The revenue to the State and Province is only two million dollars, and the value of the coal to be saved is only eleven millions of dollars.

To effect this result, a colossal sum must be spent upon which no adequate return could be expected. In other words, Niagara, like other water-falls is economically utilizable only to a limited extent, and so long as any fuel, either coal, oil, gas, lumber, peat, vegetable matter or extracts, is available as fuel, water powers will continue to afford a restricted field of usefulness, bounded by strictly limited expenditure upon development.

In this direction, the Great Experiment is therefore based upon assumptions as to the economic value of water powers, which are upon analysis, found to be exaggerated, and the people of the Province of Ontario have been led to believe that their experiment in the utilization of the "white coal" of the falls as a substitute for the other means which lie beneath their soil or near their doors, is wholly a source of gain and profit to the community. But so far as the Falls are concerned, their value is limited and the possibilities of their utilization restricted, and their use may be accompanied by loss in other directions, outweighing any monetary advantage resulting from their conversion into electrical energy.

CHAPTER IV.

THE DEVELOPMENT OF HYDRO-ELECTRIC ENERGY.

SO far as the utilization of a water power is found to be desirable, its value to the community will be represented by its greatest possible utilization. The power of falling water is a continuous supply of energy, but on the other hand, a large proportion of the purposes to which such energy can be applied are intermittent, and therefore, the power of the water can be utilized by such intermittent services only to a partial extent. It follows, therefore, that the natural and economic utilization of water powers is by such industries or processes as will, with the least possible loss in production and in transmission, utilize for the greatest period of time the continuous force of the water-fall.

That such a situation is a natural economic combination, is demonstrated by the uses of water power long prior to the introduction of methods for the generation of electrical energy, as illustrated by the use of water powers in New

England, around which there have grown up in the past large industries located at the falls and utilizing the power of the water in the most direct and continuous manner possible.

The introduction of electrical methods has not changed this economic condition, but has merely introduced a new form, by which generated power can be transmitted to long distances accompanied by a certain loss and at additional cost.

The purposes to which electrical energy are applied, such as electric lighting, manufacturing, power and railroad operation, are erratic, intermittent and variable, and do not therefore, constitute an economic use of the continuous power of the falling water. On the other hand, certain forms of industry and processes which have come into existence since the introduction of electricity, utilize the energy generated by a water power in a practically continuous manner, without the accompaniment of the loss of much of the available power during the course of the year's operations. Situated as some of such large industries have naturally been, close to the source of the production of energy, they are also operated without the accompaniment of the loss due to transmission of energy to long distances.

An excellent illustration of this economic use of continuous water power applied through electrical energy is afforded by the operations of the Niagara Falls Power Company, which with only four consumers upon its system, disposes of an average continuous load amounting to 82 per cent. of the maximum output and a continuous use of 67 per cent. of its installed capacity. Even this illustration, however, further enforces the points above made, namely, that under the best circumstances, only partial use is possible of the continuous force of a water power.

The result of this natural economic situation is that those industries which make a large and continuous use of power, naturally seek the neighborhood of available water powers, while those industries in which power is a relatively small element in their cost of production, seek other localities, where the major considerations in their process, either materials, labor or transportation, are more economically available.

The economic conditions governing this matter, in the State of New York, are shown in the relative value of power and of labor in such industries, as are now utilizing water powers. In general miscellaneous manufacturing, the value of water power is less than ten per cent. of that of labor, and in certain industries such as the cotton and woolen, the value is less than a third of one per cent.

The proportionate value of power, however, rapidly increases in such processes as paper and flour-milling, manufactures where the value of the power rises to 55 and 66 per cent. respectively, and in the case of pulp and excelsior the value of power and labor are almost equal.

Those industries in which the power forms a greater percentage of the value of the labor employed, are just those industries which would naturally be established in the vicinity of waterfalls, as they are those in which the processes are most continuous.

The average use of power which is made in the various industrial processes is very much less than the total amount of power which is installed to meet the full demand or sudden fluctuations in the use of power. The average use is that which is technically known as the "load factor," expressed as a percentage of the maximum requirements or of the installed power. Thus a factory having an engine or motor of 100 horsepower with a "load factor" of 25 per cent., would be using one-quarter of the installation or 25 horsepower on the average during its working hours.

In manufacturing industries of varied character, a comparatively small proportion of the available power is in average use, as is shown in this list:

Load Factors in Different Manufactures.

Or Percentages of the Maximum Power in Average Use.

Averaged upon a number of actual instances.

Boots and shoes	25%	Newspapers	18%
Breweries	45%	Paint	25%
Cans	30%	Pottery	13%
Carpet weaving	17%	Soap	20%
Chemical works	11%	Tanneries	20%
Clothing	18%	Twine	30%
Dye works	15%	Furniture	28%
Foundries	15%	Wall paper	12%
Machine shops	20%	Cigar boxes	6%

This average use of the power represents the amount used during the period of operation or hours of work. With the exception of a few classes of industries, this period of operation is confined to the usual working hours of labor, which amount to about 3,000 hours in a year, out of the annual total of 8,760 hours. This is about one-third of the total time during which water power is continuously operating, so that two-thirds of a water power as regards time, would be wasted in the operation of most manufacturing industries, and during the time when it is utilized, only a portion—sometimes a very small portion—of the connected or available power would be in average use.

Supposing therefore that a water power of a thousand horsepower should be utilized for the purpose only of industries manufacturing boots and shoes, this power would be utilized only for one-third of the time, and during that time only to an average extent of 25 per cent. Thus the total utilization of the water power during the year would become one-quarter of one-third of the available power, or less than a tenth of the available power.

Now, on the other hand, there are industries in which the power can be utilized in a practically continuous manner, and to a very much larger average extent. Assuming therefore, that the community is interested in the utilization of a water power, it would naturally follow that the largest gain would be secured by the community at large in such a better utilization of the power available.

As between the use of the falls by such an industry and the use of the power in an extensive and erratic utilization by transmission to long distances for lighting and manufacturing purposes, there cannot be any question that the public is the gainer by the more continuous use of the water power, the product of which then becomes a source of enrichment to the country, while the irregular and less productive purposes for which power is required can be served by other methods of power production better situated, and adapted to the irregularities of operation.

A careful examination of the value and use of power in various classes of industry, as well as in non-productive purposes, such as public and private lighting, will show that the relation of the value of the power to the value of the product is an insignificant proportion, excepting in those classes of industry to which reference has already been made, such as cotton mills, paper, pulp, lumber, iron and steel mills. It is only 5½ per cent of the value of the products in all the industries in the State of New York.

These facts all demonstrate that the proposition to convert water power to electrical energy for the purpose of its conveyance to long distances for general commercial and public purposes, is economically unsound. The useful application of energy in this form is limited and results in an economic loss of a large proportion of available energy which could be more economically and advantageously utilized in the immediate vicinity of the falls, and by such purposes and industries as require the largest possible and most continuous use of power.

It has, however, been claimed in support of the Great Experiment of the Province of Ontario, that the distribution of energy in this form was desirable as a means of attracting the establishment of new general industries in the Province, and this point of view was evidently that which influenced the opinions and actions of the business community in furthering the movement which resulted in the establishment of the Hydro-Electric Power Commission.

At the time this discussion was in progress, it was not made clear to those who engaged in it, that energy, even at a low cost, is not a large inducement towards the establishment of industries of a general character in a locality, the selection of a situation being governed by the larger elements of suitable labor, the accessibility and price of raw materials, and transportation to and from the place of manufacture, together with other questions, such as taxation, tariff, and above all, proximity to the sources of demand for the product.

Unless therefore, a locality should prove specially advantageously situated in some or all of these respects, the element of cheap energy is not of material importance. That such conditions prevailed in the territory in which the operations of the Hydro-Electric Power Commission have been exercised, has been evidenced by the results.

Another point upon which information was and still is noticeably deficient, is the progressive loss in the production of electrical energy by water power, and in its transformation, transmission and re-transformation for the various purposes to which such energy is applied in the mixed services of a number of communities. One of the best illustrations of the results of such a combination was ascertained in the case of the large hydro-electric generating, transmitting and distributing system of the city of Seattle, in which careful tests provided the exact proportion of the loss of energy due to each element in the combination. They were published about a year ago, and from them the following summary has been prepared:

	Per Cent
One water horsepower at the water fall being	100
The output in electric horsepower is	54.5
So the water horsepower used per 1 electric horsepower generated is	1.83
The transmission and transformer losses are	10.5

	Per Cent
So the water horsepower used per transmitted horsepower is	2.1
The local distribution and transformer loss is	20
So the water horsepower used per distributed horsepower is	2.52
The average peak load is, of the maximum	90
So the water horsepower per average peak load is	2.77
The average usage of peak load is	60
So the water horsepower used per utilized electric horsepower is	3.87
Or, 387 water horsepower is required for 100 electric horsepower utilized.	
And thus, the water horsepower taken is represented in use by only	26

This statement shows that the power of one horse in the water entering the power-house is reduced to one-half of its power in the form of electrical energy generated. This is further reduced by about 10 per cent, by changing the form of the electric current in a transformer, so as to provide energy with very high pressure for the purpose of its transmission over a long distance. This energy on arrival at the other end of the transmission line, is again transformed to a lower pressure, and in the case of a municipality, is required to be further transformed more than once for the purpose of utilizing any industries and in lighting.

By the time these processes have taken place, the power of the falling water which entered the power-house, has been so reduced that in order to afford the use of one continuous electrical horsepower to a municipality, 2½ horsepower in water has had to be utilized. This power, however, is the maximum or largest available use of energy which may be demanded, and is usually referred to as the "maximum demand" or "peak load," being the highest amount that may be required at any one time.

Of this "peak load" a certain amount is used on the average, and in general use, where light and power are combined, this is so reduced that it represents only about 50 to 60 per cent. of the "peak." Thus, the distributed or utilized electric power is only about one-quarter of the power entering the power-house in the form of the falling water, and nearly four times as much energy in the form of water is required as can be utilized in a general municipal system. This therefore represents the physical conditions under which the "harnessing" of water-falls and the distribution of "white coal" takes place, and to which the most careful attention must be devoted, in order to determine whether so great a waste of the prime form of energy can be made with economic advantage.

This question is naturally affected by the comparative cost of the production of similar electrical energy by other sources of power situated closer to the point of distribution and proportioned in such manner as to meet the fluctuations of the demand. Some of the enthusiastic generalizations which have been applied to the subject of water power, seem to have assumed that their general development would result in the abandonment of the use of fuels and steam apparatus, and that great economies to the population of the country would result.

Not only are such generalizations based upon a lack of consideration and knowledge, but they ignore the fact that in spite of all that has been done in the way of the utilization of water power, it has been found necessary in nearly every important instance to supplement the force of the falling water to some extent by other sources of power.

In the case of the Province of Ontario, local sources of power are available by the presence of oil in the center of the Province, and of an abundant supply of natural gas, which is obtainable in a number of localities, at prices as low as 10 cents per 1,000 cubic feet.

While it is the fact that coal is not found within its soil, yet the Province is remarkably well situated as regards the transportation of coal from the great coal districts of the United States, and in course of time the east and west boundaries may be served by water and rail with great Canadian supplies of fuel.

In all cases where the transmission of electrical energy is to be or has been undertaken, the eventual value of the operation will be limited by the comparative cost of the real production of energy. As a concrete instance, the conditions in the City of London, may be referred to. This place is rather more than one hundred miles from Niagara Falls, involving a large expense in the transmission of electrical energy. It is located very advantageously as regards the supply of oil fuel, which is situated less than one-half the distance from Niagara; and it is also about an equal distance from the Detroit River at which point supplies of coal from more than one source are available, so that coal of excellent quality can be purchased in London at three dollars per ton.

The share of the capital cost of the line of transmission of the Hydro-Electric Power Commission involved in connecting the City of London to Niagara, has amounted to $256 per horsepower used. A good steam power plant could be constructed for less than one-third of this expense.

These facts will illustrate the narrow margin of value between "white coal" and black coal, utilized under such conditions.

It may here be further stated, that the Hydro-Electric Power Commission itself has found on enquiry into the proposed extension of its electric system to certain localities, that power could be more economically generated there by the use of coal or oil. The results of a very close study of the actual costs of operation of hydro-electric and steam-electric installations, published in 1912 by Mr. A. C. Dunham, show that on the whole, in any new scheme, steam power can now be employed with much greater chances of profit than almost any water power in any part of the United States, except where coal is very high in cost, as in the far West.

One of the main considerations which led to public approval of the establishment of the scheme of Hydro-Electric service, was the attraction to the Province of manufacturing industries, which would thus add to the general wealth of the community. It has been recently asserted in a publication of the Conservation Commission of the State of New York, that the result of the introduction of the Hydro-Electric service has been that "it is attracting factories "and manufacturers from New York, who are "moving their plants to Canada and thus taking "their capital and employees out of New York "State, in order to take advantage of the cheap "power of Canada."

Careful enquiry has failed to trace any instance substantiating this wild statement. Such industries as have been established in recent years in the Province of Ontario, under the ownership and control of New York State manufacturers, were not moved out of the State of New York, but are branch or independent organizations, established for the purpose of taking advantage of the duty upon their products, and located with a view to general advantages, a minor element in which, may or may not have been the price of power. The futility of such a statement is illustrated by the fact that for a number of years prior to the introduction of the Hydro-Electric service, and during its continuance, various towns in Ontario have been offering to manufacturers electrical power at rates far below those which are available under the Hydro-Electric System.

The town of Orillia for instance, has for a number of years, provided power to manufacturers at the price of $15 per electric horsepower, a price as low as any now prevailing on the Commission System; and at several other locations throughout the Province, electric power has been available at prices below $20 per annual horsepower. If, therefore, the low price was the moving element in the establishment of manufacturing industries in this Province, such places would have attracted in large numbers the establishment of industrial and manufacturing processes. Such, however, has not proven to be the case.

Moreover, the fact that the Hydro-Electric Power Commission has now afforded to a number of towns the opportunity of entering the field of competition for the local establishment of manufacturing industries on the inducement of lower power costs, has not improved the situation of others. All the communities now served by the Niagara system are loudly calling for, and actively seeking the establishment of industries within their boundaries to help them make use of the service for which they have contracted. London has so far failed to secure any, in spite of its much advertised low cost of electric energy, which is more apparent than real, and several other cities have been sorely disappointed in their expectations in this regard. On the other hand, those manufacturers already established in such places, have secured the benefit of reduced prices for power, which have added to their personal profits, without introducing new elements of competition.

The general result of the operations of the Hydro-Electric Power Commission, therefore, in this important direction, appears to have been a failure to effect the results anticipated, and does not appear to have been the cause of an increase of manufacturing industries in the Province of Ontario.

Upon this part of the Great Experiment, therefore, the people of Ontario appear to have been led to suppose that the use of water power offered unlimited advantages, and that it would increase the wealth of the Province. There does not appear to have been any consideration given to the facts as above recited, nor to the most important necessity of the strict limitation of capital expenditure upon any system necessarily in competition with other sources of power.

We shall now see how the Hydro-Electric Power Commission proceeded to develop and carry out the experiment to which it was committed, and within the economic boundaries of which they were confined by the foregoing circumstances.

CHAPTER V.

HOW THE COMMISSION HAS GONE TO WORK.

THE Hydro-Electric Power Commission established its headquarters in the City of Toronto, and organized a technical, clerical and general staff, proportioned to the work undertaken by the Commission, the expense of which has, of course, shown a progressive increase since the year 1905.

The estimated expenditures of the Commission upon its work for the year 1911-12, amounted to $268,690, of which a sum of $95,600 was devoted to expenditure upon appliances, furniture and a laboratory, leaving the operating expenditures of the Commission at $173,090. It will be recalled that the Chairman stated that the Provincial appropriation in this expenditure was "fifty "to sixty thousand dollars a year," leaving over $100,000 to be met by the revenue of the electric systems.

The members of the Commission gave their services gratuitously to the work in which they have been so greatly interested, and it was not until the spring of 1912 that a payment in the form of an "honorarium" of $6,000 a year was voted by the Ontario Legislature to the Chairman of the Commission, in respect of the services he is rendering in that capacity.

The Commission has dealt with four problems of hydro-electric service in four widely separated localities in the Province—at Ottawa, the Niagara district, the Big Chute System, and at the City of Port Arthur.

In none of these has the Commission attempted to construct or to acquire, or even to operate hydro-electric power plants or developments, but has purchased from existing corporations a supply of energy on contract, and has then sold it to municipalities. This course has been taken after every opportunity had been afforded to ascertain the cost of operation of such power plants, and is evidence of the uncertainty of the Commission as to its ability to operate such plants to advantage.

With the exception of the City of Ottawa, in which no transmission line was required, the Commission has constructed transmission systems, extending the purchased supply of energy to the municipalities. By far the largest of these operations is that of the Niagara district, which comprises a total of nearly two hundred miles of main and one hundred of subsidiary transmission lines, extending from Niagara as far east as Toronto and as far west as London, and as far north as Woodstock.

At the Big Chute system, the Commission has constructed extensions of an already existing high-tension transmission system at the Town of Midland to several smaller communities not far distant.

At Port Arthur, the Commission has constructed a short extension of a high-tension transmission system to a transformer station, for the service only of the City of Port Arthur.

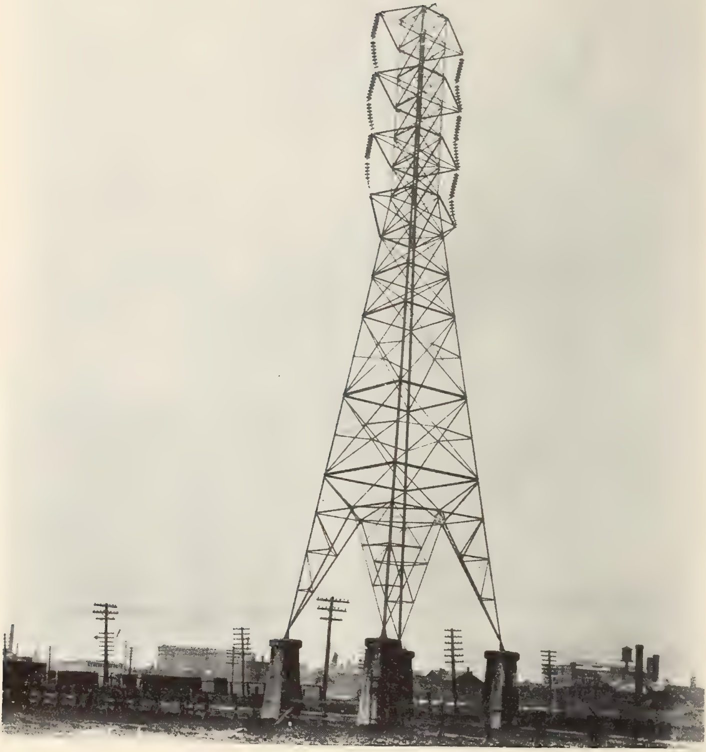
The Commission, as its operations have developed, has thus become an intermediary or middleman between municipalities and power developing corporations, constructing at the expense of the Province, transmission connections between the two parties, together with the necessary transforming appliances and buildings to contain same, thus relieving the municipalities and the companies of capital expenditure in connecting a service of high-tension electrical energy, but leaving to each community the expenditure of capital upon sub-transforming and distributing systems within their own boundaries.

The operations of the Commission have therefore involved the whole of the population of the Province through the provincial treasury in the provision of capital for the construction of connecting or transmitting systems only, and benefitting only a part of the communities of the Province. The theory upon which this course is justified is, that the moneys so expended, while obtained upon the credit of the whole community and expended for the benefit of part, will be returned in full by a strict system of apportionment of the cost due to the service rendered to each separate municipality, which return will be made to cover every outgoing, and will also return the capital by an amortization or sinking fund, the rate of which will be so proportioned as to return the total capital to the treasury of the Province at the time of the maturity of the provincial bonds, which have been issued for a period of thirty years.

The method by which this return of capital and other fixed payments has been arranged to be paid is such as to conceal its real amount within the price to be paid by each municipality for the energy supplied to it, instead of the more simple and understandable form of a direct contribution of the same. They form, however, from a financial standpoint, the fundamental and basic element in the payment which should be adhered to in the interests of the bondholders and the credit of the Province. But concealed within a price for power, they have been lost sight of by the public and evaded by the Commission.

On account of the difficulties experienced by the Commission in meeting its expenditures by the returns secured from the municipalities served, it was not long before the Commission found itself compelled to appeal to the Legislature for some financial relief. The easiest cut to relief was found in suspending the payment of the sinking fund, and an Act was passed suspending the payment of contributions to the repayment fund until the year 1914. The effect of this remarkable course of action, taken over the heads of the owners of the bonds, and thus depriving them, for a period of five years, of the security upon which the bonds had been purchased, does not relieve the community of ultimate liability, but requires the payment of the amortization to be taken up later, and then to be made in twenty-five installments instead of thirty, and while thus aiding the present stringency of the Commission's finances, to a substantial extent, it merely postpones the payment and will require it when commenced, to be maintained at a higher annual rate.

The rate of amortization adopted by the Commission is based upon the compounding of the sinking fund accumulations, at a rate of 4 per cent., or in other words, their re-investment in other bonds of the Province. This fixes the annual payment at the rate of one and eight-tenths per cent. of the total investment, based on thirty



An Angle Tower on the Toronto Entrance Line.

yearly payments, but owing to the postponement this rate will be increased to two and four-tenths per cent. per annum commencing in the year 1914.

Whatever may be the financial results of the present operations of the Hydro-Electric Power Commission, they must be modified by the fact that this important element has been omitted from their expenditures, and has to be faced in full at a not distant date.

The second main theory upon which the operations of the Hydro-Electric Commission have been based, is the re-sale of the product purchased by the Commission at its cost, and at neither more nor less than its cost. In following out this principle, which lies at the base of the Great Experiment, the Commission was evidently placed between very narrow margins of liberty in its operations. If, on the one hand, it expended the least possible capital upon the construction of connecting and transmitting systems, its operating expenses would be increased; and, on the other hand, if it expended capital freely upon the highest class of construction and materials, its fixed charges in capital would be increased. Between these two elements, the Commission evidently chose the latter, and has expended money freely upon the highest class of construction and appliances throughout the work it has undertaken to build, with the result of a high proportion of fixed charges upon its operation.

The difficulty attaching to the maintenance of cost and revenue at the same level in a complicated service, such as the purchase and re-sale of electrical energy to a number of consumers, is one which naturally is appreciated best by those who have had to deal with similar problems of production and sale on commercial lines, in which a considerable margin between revenue and cost is expected. Such a margin naturally offers some latitude for a rise in cost, or a decrease in revenue, or for unseen contingencies, and even under such circumstances, the financial problem is a difficult one.

The financial operations of the Commission on this system are accompanied by an initial difficulty. No provision appears to have been made for the contingency, such as has developed, of a deficiency in revenue to meet the outgoings of the Commission, and in order to deal with the emergency thus arising, recourse was made first to the suspension of the sinking fund, and secondly, to the writing in or charging to capital account of deficiencies in the cost of operation. This latter is a practice which, if it should be followed by private corporations, must necessarily lead to complications and burdensome capital expenditure, even if it should not prove to be eventually the high road to bankruptcy.

In the case of the Commission, however, it has so far been followed without observation on the part of the public, due to the remarkable fact that for three years past no report, financial or otherwise, has been offered to the public by the Commission, which has only made, through its Chairman, generalized statements and assertions as to its accomplishments.

In the summer of 1912, the New York State Legislative Committee directed to enquire into the workings of the Commission, with a view to advising the Legislature upon the proposed adoption of a similar system in the State of New York, visited various cities in Ontario and took testimony from members of the Commission and from others as to the financial and physical operations of the Commission, during which enquiry the facts of the financial position of the Commission began to be apparent.

The enquiry has resulted in establishing the fact that the operations of the Hydro-Electric Power Commission have been and are being conducted at a serious loss, and that a large expenditure of capital has been incurred upon a limited amount of public service rendered. The establishment of rates at unduly low figures at the inception of the undertaking, and their further reduction, from time to time, to meet competition and apparently to influence public opinion favorably, have been contributory causes.

Up to a certain point the experiment of Ontario in electrical service afforded an illustration of the conduct of a difficult problem in an honest and sincere manner, and its shortcomings are not to be attributed to crookedness or graft, often such strong arguments against governmental operations. The financial situation of the Experiment has been brought about by lack of appreciation of circumscribing conditions and errors of judgment, and as the facts become known it is evident that both have been contributory causes. The results are such as would be likely to flow from the control of so difficult a financial problem by those who were inexperienced in similar operations, and were uninformed upon the technical features of their work. But the more recent actions of the Commission, in misleading the public, and concealing the true facts of its financial operations, cannot be regarded in the same light.

The operations of the Hydro-Electric Power Commission developed three forms of public expenditure:

1. Upon the expenses of the Commission by the Province.
2. Upon the capital cost of the construction of transmission and transforming systems, loaned by the Province.
3. Upon local distributing systems, provided by the municipalities.

The result of these expenditures up to the present date have been, in the four systems previously referred to, the utilization of power to an extent of less than 33,000 horse-power, divided as follows:

Niagara system	24,000	horsepower
City of Ottawa	4,500	"
City of Port Arthur	2,000	"
The Big Chute system	2,500	"

This power is purchased from the several sources of supply at prices differing in each locality, the costs being as follows:

Niagara system, 24,000 h.p. @ $9.40	$225,600
Ottawa, 4,500 h.p. @ $15	67,500
Port Arthur, 2,000 h.p. @ $16	32,000
Simcoe, 2,500 h.p. @ $17	42,500
Total—33,000 h.p	$367,600
Average per horsepower	$11.14

The power thus secured has been sold by the Commission at prices which, up to the month of October, 1912, average throughout $24 per horsepower, reduced by the new scale of rates upon part of the Niagara system at October 1, 1912, to an average of $22.56, and again in December, 1912, to an average of about $19.30.

The difference between the purchase price of the current and the sale prices prevailing up to October 1, 1912, has been, therefore, only $12.86.

The capital expenditure of provincial funds upon these several systems has been over four and a half millions of dollars, and, up to October 30, 1912, stood at the following figures:

The total capital expenditure at October 30, 1912, on the Niagara System, was $4,158,829. There has been expended by the Commission upon other Hydro-Electric systems, $344,772. The capital expenditure on the Niagara and other systems will therefore amount to $4,503,600.

The fixed charges upon this sum of money consist of interest at the rate of 4 per cent.; sinking fund at the rate of 1.8 per cent.; depreciation at the rate of 5 per cent., amounting in all to 10.8 per cent. per annum.

This represents upon the energy sold, $14.73 per horsepower.

Added to these charges, there is the cost of operating the systems constructed, and their maintenance in operating conditions. These were estimated by the Hydro-Electric Power Commission upon the Niagara system to amount to $193,160 per annum.

In the other three systems, the same elements involve an approximate annual expenditure of $40,500, making a gross annual expenditure of $233,660. Upon the energy sold, this would represent $7 per horsepower.

These facts clearly indicate the financial situation in which the Commission has become involved.

The total cost to the public of the service rendered by the Commission in power purchased and delivered, has stood as follows:

Expenditures of the Commission, per horsepower	$8.30
Fixed charges on Provincial capital expenditures, per horsepower	14.73
Purchase price of power	11.14
Operation, maintenance and administration, per horsepower	7.00
Making total, per horsepower	$41.17
As the average rate at which this power has been sold, up to September, 1912, was $24, the deficiency has been, per horsepower	17.17
Which represents an annual loss at the rate of $647,130.	
By recent reductions in rates on the Niagara system the loss per horsepower has been increased to	$18.61

The method by which this great deficiency is being concealed from public observation is, by the omission of essential elements composing part of the cost, namely: the expenses of the Commission which are not made known or charged against the cost, also the sinking fund, the depreciation accounts, and the provision for maintenance.

But the fact cannot be gainsaid that the Commission has not carried out the principle upon which the Experiment was based; that the consumers of electricity should pay the cost of its acquisition, without loss to the Province. The postponement of obligations and neglect of proper provisions, is not a relief to the people from the burden of loss, and the accumulating deficiency must inevitably come with excessive force upon the various communities when the necessary increase is made to the rates as now charged. This will now require to be sufficient not only to cover all current outgoings, but to make up past deficiencies, and requires nearly double the present price charged to the municipalities.

To the results which have thus come about in the operation of the Hydro-Electric Power

Commission, there must be added the expenditures and costs which the various municipalities have undertaken by their acceptance of this service and in their preparations for the distribution of electrical energy within their own boundaries. An examination of the bond issues of the various municipalities upon the four systems has been made, and the total aggregates $8,348,000 up to the first of September, 1912. This, added to the capital expenditures of the Commission, brings the total investment on the part of the people of Ontario upon this Experiment to $13,148.000.

The fixed charges upon the municipal expenditures are somewhat higher than those upon the Hydro-Electric Power Commission's capital investment, because the average municipal interest, with discounts upon the sale of bonds, is approximately 5.2 per cent., or 1.2 higher than the provincial rate of interest.

These bonds have, for the most part, been issued for a period of thirty years, and are to be repaid in certain cases by annual installments, and in the majority by a sinking fund or amortization payment of 1.8 per cent. per annum. Depreciation upon municipal installations is set aside by certain municipalities and ignored by others, but at the average rate of 5 per cent., the fixed charges aggregate 12 per cent.; and upon the expenditures so far made these fixed charges involve an addition to the cost of $30.35 per horsepower per annum.

It is interesting to follow the progressive increase in the cost to consumers and the municipality of power thus secured. An examination of the annual accounts of several municipalities on the Niagara and other systems of the Commission shows that to the price of power as now paid, the cost of distribution and municipal administration adds from 47.7 per cent. to 75 per cent.

The physical loss of energy in local transformation and distribution of the energy purchased may be moderately estimated at 20 per cent. The power purchased by the municipalities is based upon the maximum demand or highest point of use during the month. If the use made of this power is less, the price or cost must therefore be distributed upon an average, which would be favorably assumed at 60 per cent. of the maximum.

The progressive additions to the cost of the service supplied to the municipalities is therefore as follows:

The average price charged by the Commission being taken at	$22.56
Fixed charges on capital cost, per horsepower purchased	30.35
Municipal administration and operation at average of 60% of the present cost, or per horsepower	13.54
Losses in transformation and distribution at 20% of the total cost, increase the price by	13.29
Making the cost per distributed horsepower of maximum demand at the prices charged	$79.74
If, however, the full cost of the operation and expenses of the Hydro-Electric Power Commission were being paid, this price would be increased by	18.61
Making the total cost per horsepower	$98.55
Upon the average use of about 60%, this becomes, per horsepower, as utilized by the consumer	$164.00
This is the average cost to the municipalitities which is about the same as some steam power plants, and would be equivalent, upon the general working period of 3,000 hours, to a cost of 5½ cents per horsepower hour.	

But it may be claimed, and it has been asserted that even if the effect of the work of operation be productive of a financial loss, the result has been a large and widespread benefit to the community. Such an assertion is interesting and worthy of analysis.

The expenditures of the Commission have been made, with a few exceptions, where certain manufacturers have been favored with a direct service, upon the supply of electrical energy to municipalities. In a number of instances, these municipalities were already provided with services of electrical energy from privately owned concerns, and in other cases were already in possession of hydro-electric or other power plants, upon which considerable municipal investments had been made. In nearly all instances the introduction of the electrical supply involved the issuance of bonds to raise money for the purpose of constructing distributing systems, and in many cases for the extension of existing lighting systems and purchase of machinery for the sole purpose of making use of the energy purchased.

A large proportion of the capital expended by the municipalities has been dissipated in the construction of parallel distributing systems, duplicating existing electrical systems or discarding existing facilities owned by municipalities, or in extending, sometimes to quite an extravagant extent, existing public lighting systems.

So far as the general interests of the whole community are concerned, the credit of the Province and of various municipalities has been used to borrow funds, to a total of approximately thirteen millions of dollars. Only a small proportion of this expenditure has been of a reproductive character, bringing any increase of wealth to the Province; the major portion of the expenditure having been invested in non-returning or unproductive purposes in the form of public conveniences, such as lighting, often at an increased expenditure of public taxes; and to a large extent upon increased conveniences in domestic lighting, involving increased expenditure of private resources.

The operations of the Commission have fallen short of the actual ownership of any hydro-electric development or of the construction of any permanent works of that nature. For reasons not necessary here to repeat, it seems fortunate for the Province that this has been the case, but it nevertheless leaves the situation in the position that these expenditures represent no more than a system of overhead transmission lines and some transforming apparatus, of little or no value without the accompaniment of power developments, now owned by private corporations; and which systems, if the corporations should find their operation unsuccessful and should be compelled to abandon their developments, could only be restored to use by a further and much larger expenditure on the part of the people of the Province in the expropriation and resuscitation of the power developments.

Moreover, no part of the expenditure so far incurred, includes any reserve or emergency machinery in the form of steam power plants.

As to the general results upon the interests of the Province, probably by reason of those economic causes previously described, it does not appear that any substantial difference to the manufacturing industries of the Province has resulted from the distribution of electrical energy. The industries already in existence have only to a partial and limited extent made use of the power thus rendered available, and in most of the communities upon the Niagara system the existing local industries seem to have preferred to remain connected to the service of private corporations, at the reduced rates, chiefly because the latter are provided with reserve sources of power, available in case of the breakdown of transmission lines, with which safeguards the Hydro-Electric Power Commission system is not provided.

It cannot, therefore, be said with justice that the Experiment of the Hydro-Electric Power Commission has added to the economic welfare of the community to any appreciable extent; but on the other hand, it remains a stubborn fact that it has involved both the Province and the municipalities in a very large addition to their existing indebtedness. These additions and their relation to prior debts and to the assessed valuations are shown in the accompanying tabulation.

In analyzing these figures, it becomes apparent that the effects of the burden of additional debt are different in the case of the larger communities from that in the smaller communities, and therefore, a division of the municipalities forms a proper basis on which to consider the effects of the indebtedness which has been incurred. The two large cities of Toronto and Hamilton stand in a class by themselves—the city of London coming next nearest to Hamilton in this respect. Six smaller municipalities form the next group, and fourteen small townships and villages comprise the rest of the communities upon the Niagara System.

Hydro-Electric Commission Niagara System.

Relation of Populations, Valuations, and Assessed Valuation. Indebtedness.

	Population.		Assessed Valuation		Debenture Debts		Electric Bonds	
Totals	618,687	100%	479,654,674	100%	55,629,630	100%	7,348,616	100%
Toronto and Hamilton	458,121	74	395,819,854	82.3	43,693,000	78.45	5,405,160	74
Six Towns........	113,800	18.4	62,939,000	13.3	9,520,558	17.25	1,393,391	18.8
Fourteen Villages.	46,766	7.6	20,895,820	4.4	2,416,072	4.3	550,065	7.2

Share of H. E. System			Total Indebtedness		Total debt relation to Valuation	Total debt per capita	Electric Additions to debt
Total	3,803,901	100%	66,782,147	100%	14%	$108	20%
Toronto and Hamilton..	914,384	24	50,012,544	74.8	12.63	109	14.5
Six Towns	1,761,130	46.3	12,675,079	18.8	20.1	111	33.1
Fourteen Villages......	1,128,387	29.7	4,194,524	6.4	19.6	87	70

It will be seen from an examination of these figures that the relation of the assessed valuation of the communities to their debts, prior to the expenditures upon electrical purposes, was fairly proportioned to their populations, but as expenditures upon electric services and systems are added to the debts, the proportion begins to be much more burdensome to the smaller communities than it is to the larger municipalities. The system which has been followed by the Hydro-Electric Power Commission in distributing the capital cost of the Niagara System is highly disadvantageous to smaller municipalities, resulting in their bearing a disproportionate share of the cost of the system, and through the price of power delivered to them, an unequal share of the costs of operation and maintenance.

The combined expenditures of the Commission and of municipalities has very substantially increased the total indebtedness of the various communities, and the municipal bonded debt is found to have been increased in the case of the two large cities, 14½ per cent.—in the six towns, 33 per cent.—and in the fourteen small communities, no less than 70 per cent.

The result has been to increase the relation which the indebtedness of all these communities bears to their assessed valuation, which now stands at a general average of 14 per cent., being much higher in the case of the small municipalities and villages, where the proportion is 20 per cent.

The burdens as thus stated may not be appreciated by those who are not acquainted with the effect of such situations upon the financial credit of communities, but a little consideration on their part will convince them that it is a natural result of such a narrowing of the margin between assets and debts, that the debtors find it increasingly difficult to borrow funds and generally find it necessary to pay a higher price for loans as the proportion of the debt increases. The case is similar to that of the owner of a property who places a second mortgage upon his property, by which the value of the property itself is not reduced, but the additional load reduces the margin of credit and so forms a bar to the borrowing of still further amounts, except at increased rates of interest commensurate with the increased risk to the lender.

Thus, in the case of municipalities, the undue proportion of debt to assets or assessed value of the properties of the community renders it increasingly difficult to dispose of further bond issues at rates of interest such as have been secured in the past; and it is a fact that these rates have recently been advanced, and the cost of disposing of issues of municipal bonds have been increased, not only in the case of the small communities in Ontario, but in the conspicuous instance of the City of Toronto.

The market for the securities of municipalities in Ontario has been in the past an extremely favorable one for the borrowing of money at low rates of interest, largely because conservative investors in England have looked with favor upon the methods and security of Canadian municipalities; but when the credit thus established is used, as has been the case during this Experiment, for the purpose of expenditure upon unproductive and unnecessary outlays, then sooner or later the conservative investors will hesitate in purchasing the security, or if they buy, it will be at a higher rate of interest, commensurate with an increased risk.

When so large an operation as this Experiment is accompanied by a measure of such a doubtful character as the suspension by legislative authority, of the sinking fund forming a part of the securities, it must be evident to every conservative person interested in the welfare of Ontario, that a serious reflection has been made upon its credit. That this has been the case is evident from the occurrences which took place in the summer of 1912, when the City of Toronto, in the ordinary course, negotiated with Canadian financial institutions an issue of debentures for urgently necessary public improvements, but found that the rates asked had been substantially increased from that which had been readily obtainable in the past.

The unusual course was then taken by the city authorities, of sending the City Treasurer, and later on the Mayor of the city, to England, where these responsible officials spent some time in a vain effort to sell the bonds of the city in that great financial center; and succeeded only in negotiating a temporary loan upon the notes of the municipality, at an increased rate of interest accompanied by a discount.

The inequalities of a Governmental distribution of the costs, of such a system as the Hydro-Electric, are more readily appreciated when the various classes of communities are separately considered, as in the following statement:

THE DISTRIBUTION OF THE COSTS OF THE NIAGARA HYDRO-ELECTRIC SYSTEM UPON COMMUNITIES.

	Of total population.	Of the 3 cities.	Of the H.P. now used.	Share of capital cost 1912.	Resulting share of loss on operation.	Per capita investment.
3 large cities are	81%	100.	60.8	41.	44.7	$3.11
6 towns are.....	12.3%	15.2	17.8	30.	29.1	14.84
13 townships are	6.0%	7.4	16.2	20.9	22.8	21.40
5 villages are...	7/10 of 1%	8.6	1.2	3.55	3.2	31.00
Institutions and commercial ...	—	—	4.0	4.55	—	—

In this tabulation, the various communities are compared as to population, as to the energy utilized, their share of capital cost, and their share of the loss involved in operation by the prices which have been paid for their power supply. This comparison shows that the three larger communities, Toronto, Hamilton and London, comprising eighty-one per cent. of the total population served, absorb fifty per cent. of the electric service, at a shore of the capital cost of only forty-one per cent., and this share of the indebtedness is only $3.11 per head of their population, as compared with a burden rising from $14.84 to no less than $31 per head of population in the smaller towns and villages.

The figures scarcely illustrate the full force of the burden borne by certain parts of the community, since the per capita debt in certain of the small communities is much higher than the highest figure in the table of averages.

These results indicate rather plainly an inherent difficulty laying behind an Experiment dealing with a utility of the peculiar character of an electrical system. The problem involves a fair distribution of costs upon the whole community, while the project is necessarily devoted in great part to the benefit of special classes and is peculiarly profitable to a proportion of private interests, and of no advantage to others. The conditions are entirely different under private operation where the customers are not investors, and therefore have no proprietary rights.

The financial adjustments in private operations among various classes of customers is facilitated by the margin existing between cost and revenue, and any deficiency is at the expense only of the investors, who have speculated in establishing the industry, without drawing upon the resources of the community.

Unlike well settled forms of necessary public utilities, such as a supply of water, streets and sewerage systems, in which all the members of a community share freely to the extent of their particular requirements, a service of electrical energy is a partial or preferential form of utility or convenience, utilized to the profit of one person and to the convenience of another, accompanied by expense which bars its use from the majority and which is also necessarily inaccessible and therefore unavailable to many who have thus to share in its expense. It is not comparable even with public conveyance or transit, although that also is partial in the distribution of benefits secured at general expense.

The effect of the attempt to distribute upon the general credit such a service, either to individual municipalities, or through the municipalities to individuals, is also favorable to the larger consumers. In the case of municipalities, the larger communities gain at the expense of the smaller ones. Toronto has got the best of its neighbors upon the Niagara Circuit, at every point.

The distribution of the cost of the electrical service places a proportionately low price upon a proportionately large usage of the commodity. But in this governmental operation, this should have been modified by the relative share of the prime cost. But even so, this results in progressive advantage to the large consumer as time proceeds, and progressive disadvantage to the small consumer. In the carrying out of the Experiment, the capital cost has been arbitrarily apportioned as a part of the cost of the service, and by reason of their relative insignificance, it has thus come about that the small communities have allowed themselves to be saddled with a disproportionate share of expenditure. Toronto and London are at the extreme ends of the transmission lines, using the major part of the service they supply, yet paying only a small proportion of the cost they have involved.

The burden has also in part been spread upon others who receive no benefit whatever from the operations, past, present or future, of the Hydro-Electric Power Commission, persons who cannot now, or in future, be reached by their services. Thus, the expense of the Commission itself is being paid out of the taxes of the people of the Province of Ontario, and the deficiencies so far as they have accumulated, can only be met from a similar source. One of the strangest facts is that the corporations affected by the competition of the Hydro-Electric Power Commission and of the municipalities' operations, are obliged to carry on the same operations and pay taxes in addition, and are thus contributing by their taxes towards the capital cost and the deficiencies of operation of the whole governmental and municipal systems. Their rates for service which are practically fixed by the competition of the municipalities, directed by the Commission, have to carry taxes, and also provide for some profit.

Some effect of the financial operations of the Commission, which is now extending into large figures, is even becoming apparent in the finances of the Province of Ontario, the annual estimates of which, for the year 1912, exhibited an estimated deficit of approximately one-quarter of a million dollars, or almost precisely the amount of the estimated expenses of the Hydro-Electric Power Commission.

The capital expenditures so far incurred by the Hydro-Electric Power Commission are not all that are contemplated in the near future. A statement accompanying estimates for future construction by the Commission, presented by its Chairman to the Legislature in February, 1912, showed the probable requirements of capital to be raised by the sale of the bonds of the Province for the current year, amounting to $1,870,000. In addition to these, the Chairman gave also details of a number of schemes for the extension of the existing systems and the construction of new transmission systems, amounting to a total of $4,827,000, a sum somewhat more than that already expended by the Commission, but affording service to communities of a less important character than those already served, and affording less opportunities for use of electric energy.

To this is to be added a further contemplated expenditure upon the construction of a power development at Chats Falls, which is expected to cost more than two millions of dollars, and for the output of which there does not appear to be any present demand.

These expenditures, added to those already incurred, would bring the investment of Ontario upon the distribution of electrical energy to about twenty-two millions of dollars, to which will be added such expenditures of the municipalities as may be thereafter connected to the proposed systems, and which will probably amount to an additional four millions of dollars, making the gross expenditure approximately $26,000,000 in the near future, if the process should be carried on.

The present capital outlay exceeds a cost of

$400 per horsepower, which has been expended on transmission and distribution systems only. The cost of power plants would add about $133 per horsepower, and of reserve steam plants $80, making the total cost of installation about $500 per horsepower. This is about three times the cost of fairly economical steam or other fuel, power plants, combined with local distribution systems.

The Canadian Falls and Terrapin Point.

CHAPTER VI.

FROM THE PUBLIC POINT OF VIEW.

ONE of the assumptions upon which the establishment of the Hydro-Electric Power Commission was based appears to have been that without the exercise of such governmental offices the municipalities of the Province would have been deprived of a share in the advantages of Niagara power and other water powers of the Province, and that the smaller communities could not expect a supply of power for municipal purposes to be afforded by private agencies. This assertion has been advanced elsewhere, as a reason for governmental and municipal operation of electrical utilities as opposed to the principle of governmental regulation of the charges or rates of private corporations. But in Ontario a number of hydro-electric developments were already in existence prior to the commencement of the Great Experiment, and others have been brought into operation without its aid. Private systems, such as that of the Electric Power Company, covering a large part of the interior of the Province, have been successfully in operation serving in some cases very small communities, and nineteen municipalities own and operate their own hydro-electric power stations, which aggregate a total of nearly 11,000 horsepower. Among these places are Orillia, Kenora, Port Arthur, Bracebridge and Renfrew.

In addition to these water developments, publicly owned and operated, there are various places in which steam or other forms of municipal power plants have been constructed, some of which had been in operation for years prior to any conception of the Great Experiment.

The City of Berlin had expended a sum of $208,300 upon electrical and gas installations, which included over $80,000 spent upon a gas-operated power plant of high efficiency, which has been rendered of no material value by the adoption of the Niagara service.

Another point which was advanced as a reason for the establishment of the Experiment, and one which undoubtedly influenced public opinion in its favor, was the alleged overbearing attitude of power companies in their dealings with the public, a statement re-asserted in a recent publication of the Conservation Commission of the State of New York, a brochure under the catchy title of "Cheap Electricity for All," among other mis-statements contained therein.

Careful enquiry has failed to elicit information substantiating this broad assertion. The attitude towards agitators and politicians probably was and may be hostile, but does not appear to have been dissimilar towards the public to that at present prevailing.

The broad result, as we have seen, of the introduction of hydro-electric service through the Province has been to increase, by fifty per cent., the competition among the communities, already owning power developments. The result, however, still leaves the advantage as regards price in some of those communities, which had nothing to do with the hydro-electric service, on account of their small capital investment. There are upwards of fifty such instances, and power is offered by several of them at less rates than the hydro-electric service.

The record of the agitation which preceded the establishment of the Hydro-Electric Power Commission, makes it evident that the movement was largely fostered by manufacturing interests in regions other than those in which such cheap power was already available, and their advocacy of a reduction in the cost of power, at the expense of the general community, served their personal interests by securing as low rates for power as could have been obtained had they been established in those localities which possessed particular advantages by their location at the sources of cheap power.

By the establishment of the governmental system, such manufacturers secured the introduction of the hydro-electric system into a number of towns, and a direct competition with existing electric systems, which had the effect of making large reductions in the price of power, bringing them a direct pecuniary benefit. That having been accomplished, however, it is found that the manufacturers and industries in several of these communities do not support the governmental system, but continue to utilize the service which has supplied them in the past, at the lower rates established. They have secured all the advantages that can accrue to them, and which, in the utilization of the governmental system, would involve them in expense, by reason of necessary changes in their apparatus. A contributory feature is found in the lack of provision for the security of operation in case of failure of hydro-electric supply. But it is a notable fact that no reduction in the cost of products can be traced to the lower rates established by or as a result of the Hydro-Electric Power Commission's operations, and therefore the benefit has been absorbed by the proprietors of these industries without benefit to the public.

Therefore, the general result of the operation of the Hydro-Electric Power system in these directions, to which so much public attention was directed appears to have been a failure to effect anticipated results; and the cost of the service even at the prevailing rate is such that it not only fails to compete with already existing municipal developments in other communities, but it has involved such expenditures in some of the municipalities now served, that it is doubtful whether the service is as economical as the use of steam, oil or gas power.

One of the physical features which has contributed towards this result is that the Commission decided to make its electrical system of a different character from that which was commonly in use for manufacturing and industrial purposes, thus involving a change in the character of motive appliances where the service should be adopted.

The system adopted by the Commission was what is known as an alternating current having 25 alternations or reversals of direction per second; whereas the system most commonly in use in Ontario, was what is known as a 60-cycle service, or 60 alternations or reversals per second. Large investments in machinery had been made to suit this system.

Another point which has affected adversely the interests of the municipalities engaged in the Hydro-Electric service, in securing the custom of manufacturing industries, is, that the price which the municipalities themselves are to pay for the service supplied to them, is an uncertain figure. The contract price was merely a figure at which it was assumed the municipality could be supplied, but upon which, nevertheless, the vote of the ratepayers and the inducements to municipal councils were made. Until very recently, most of the municipalities have been paying a price in excess of the figures named in their contracts. Even this price, includes only part of the full costs, part of which, such as the sinking fund and other charges, have been held in abeyance. It is natural, therefore, that the manufacturers of a district, knowing that this doubt exists, feel a lack of security with regard to the price for power which may later on have to be paid by the municipality, and in which they may find themselves involved, if the local private system should be crowded out of existence. The maintenance of the private systems has become an important factor in checking a rise in municipal prices, a remarkable reversal of the original feature.

Finally, it may be noted that in some of the instances of the introduction of hydro-electric power, the result has been a failure to effect a reduction of the prices. This is notably the case in the cities of Ottawa and Hamilton, where the prices established by local companies were already on a very low basis, as low as could be commercially justified.

Whatever may have been the considerations which brought about public approval of the scheme of the Great Experiment, there can be no doubt that there has been a general popular impression favorable to its institution and continuance. That this favor is due to lack of information upon the subject, is more than probable, and the extent of public opinion adverse to the scheme, or which has held approval in reserve, has never been demonstrated; on the contrary, the votes which have been recorded in the different municipalities and villages have been, with one or two exceptions, favorable to the local adoption of the Hydro-Electric service; and it is perhaps to be expected that those who are concerned in the maintenance of the scheme should make use of this general fact as a proof of public approval and support by the people of the Province.

The Chairman of the Commission, on the occasions of his public addresses, has rarely failed to draw attention to the overwhelming character of the popular votes upon the question of local adoption of Hydro-Electric service. Assertions when reiterated often have the effect of directing attention to the details of the subject, and a careful compilation of the statistics as to these votes, discloses the fact that they were of an extremely restricted and partial character, representing only a small proportion of those entitled to express an opinion upon the subject, which number is, of course, only a proportion of the total population.

As previously mentioned, those entitled to vote upon this question are ratepayers only, and these naturally constitute a minority of the population.

Upon a subject of this character, even if a considerable degree of prior discussion and information has taken place, it usually follows that only those pronouncedly in favor of a proposition take the trouble to record a vote upon the subject. This is a condition well known and established in questions of a general character, such as are submitted to referendum. In a general way, the positive side of such subjects is always that which produces the largest number of votes, but the number of persons voting is usually found to be a minority of the total entitled to vote.

Such results appear upon examination of the figures of the votes taken upon the Hydro-Electric service, in all the communities which voted upon the subject, in the year 1912, in which those entitled to vote upon the subject are approximately thirty-seven per cent. of the population, and of those thus qualified only about thirty-five per cent. took part in the vote. The majorities constitute about seven and one-half per cent. of the population.

ANALYSIS OF SOME VOTES.

On Adoption of Hydro-Electric Commission's Service, 1912.

	Population	Total Ratepayers	% of Total Pop.	Ratepayers Voting	% of Ratepayers Voting
Goderich	4,522	1,600	35.4	715	44
Barrie...........	6,428	1,980	30.9	460	23
Prescott	2,801	1,200	42.8	168	14
Southampton	1,681	499	29.8	302	60
Mimico..........	1,407	700	50.0	144	20
Port Dalhousie...	1,170	215	18.4	128	60
Brussels	902	394	43.8	394	100
Port Stanley.....	896	578	64.5	172	30
Lucan	709	375	52.8	151	40
Ailsa Craig......	568	205	36.2	88	40
Total	21,084	7,746		2,722	
Average			37%		35%

The significant facts derived from these figures lies in the information it affords as to the proportion of those entitled to vote, who took part in the vote, which averages only about one-third of the number entitled to express an opinion upon the matter. It may be said, with truth, that the active interest exhibited by those who voted entitled them to prior consideration over the larger number of their fellow-voters, who failed to record their opinion upon the matter. It must, however, be borne in mind that in local discussions, many people of retiring disposition avoid placing themselves on record against what appears to be a popular movement, or in which they may be regarded as retarding the "progress" of the community. Whatever may be these unknown elements, there can be no question as to the character of the inducements held out to those who voted in favor of the scheme, and the glittering generalities which were indulged in by those who favored the adoption of the Hydro-Electric service. But, such as they are, the votes upon this subject do not bear out the claims made as to an overwhelming record of popular support of the Commission's system.

An illustration of the influences brought to bear upon these voters, is afforded by the assertions publicly repeated on a number of occasions by the Chairman of the Hydro-Electric Power Commission, and widely circulated in the press, to the effect that the public of the Province has derived from the operations of the Hydro-Electric Power Commission enormous gains by the reduction of the rates charged for electricity by private companies, prior to the introduction of the Hydro-Electric service. In his testimony before the New York State Legislative Committee, he said:

"We estimate that the saving to the users of electricity in the districts supplied by the Commission will amount to over two million dollars a year."

Such an assertion is calculated to influence those who are not in a position to analyze the statement, and who are not shown the fact that any such advantage is secured by a small number of the population, and that the major advantage inevitably goes to those who can best afford to do without it; and that whatever be its nature, the result has been gained at the expense of the community at large.

The figure stated by Mr. Beck is a gross exaggeration, based upon no definite statistics, and readily found to be of this nature upon examination.

Exact statistics upon this subject are available in the three largest communities upon the Niagara system, namely, Toronto, Hamilton and London, the populations of which form 81 per cent. of the whole of the communities supplied by the Niagara system. These three cities are at present utilizing over 60 per cent. of all the energy supplied by the governmental system, but are contributing through the prices which they are paying, only 40 per cent. of the capital cost of the undertaking.

The rates which were in operation in these cities under the service of private companies, prior to the establishment of the Hydro-Electric Power Commission, have not been reduced at all in the City of Hamilton, but have been reduced in Toronto an average of 40 per cent., and in London an average of 50 per cent., these being the two cities in which the original agitation largely centred.

Toronto is serving through the municipal system and the private corporation 31,000 consumers, the gross revenue from which from both services amounts to $719,500 per annum, this being 40 per cent. lower than the prior rates, represents a gain to those 31,000 persons, of the sum of $478,000. This is not only the gain to those who were utilizing electricity prior to the establishment of the Commission, but to those who are now using the service of the Commission and of the companies at now established rates.

The City of Hamilton has upon its municipal service only 400 consumers, but these receive no gain in any reduction of rates, as the municipal price is similar to that of the local company, and these rates have not been reduced.

London has on both its municipal and its private systems 6,100 consumers, and the reduction in rates applied to both systems which has been brought about, represents a gain to these persons of $174,200. A total reduction of $652,200 is therefore being shared by 37,100 persons, or an average per consumer of $17.50 per annum.

It may, however, be assumed that each of these consumers represents an average of four persons to a consumer, thus making the total number of persons indirectly and directly benefited 148,800. This, however, is only 30 per cent. of the total populations in those cities.

The apparent gain which is thus distributed over this limited portion of the population is, of course, largely in excess of any gain to the remainder of the municipalities upon the Niagara System, but it is of interest to observe the cost to the three cities which has been incurred in bringing about this reduction in rates, with its gain to the limited number of consumers.

The share of the Hydro-Electric system which these cities have pledged themselves to pay off amounts to $1,583,000. The reductions have really been brought about by the construction of competing municipal systems, which have cost the three cities $5,768,000.

Thus a total capital expenditure amounting to $14.60 per head of the whole population of these cities, has been incurred, amounting to $7,351,000. But further in the operation of the municipal systems, it is found that the public expenditures of these cities on lighting and pumping has been increased by $225,000 per annum, so that the real effect of the operation of the Hydro-Electric Power Commission in these communities is that 30 per cent. of their population are deriving a benefit in the reduction of rates of approximately $652,200 per annum, while the rest of the community are paying out in the form of additional municipal expenditures derived from taxation $225,000 per annum.

In order to bring about this situation, the same municipalities are involved in the annual payment of the sinking fund upon the capital expenditures, amounting to a sum of $132,318 per annum. The net result of the whole operation, therefore, is to reduce the apparent gain in the rates by $357,000, making the actual gain from the reduction in rates $295,000, which is shared by the 37,500 consumers at the average rate of $8 each per annum. And every man, woman and child in all the three municipalities has gone into debt $14.60 to bring this about!

This profit has been shared between the consumers of light and power, the latter being naturally the largest consumers, thus securing the larger share. This analysis illustrates the ease with which exaggerations may be published, compared with the labor of their investigation and contradiction.

Probably the most direct influence that has been brought to bear upon the general public has been in the reduction of the prices, or rather the rates, for domestic lighting, a subject which naturally appeals to a large number of consumers of electricity. Much of the florid dissertations of the Chairman of the Commission and his associates before the public has been devoted to the advantages to be secured by the workingmen of the Province in the use of electricity in their homes. "The idea of making electricity cheap," said Mr. Beck, "is to enable householders to use "it for ironing, for lighting, cooking and heat- "ing, for operating vacuum cleaners, motors to "run sewing machines, the wringer, the washing "machine, and to pump water. We hope to have "cooking apparatus sufficiently low priced to en- "able the workingman and the farmer to use "electricity for cooking purposes." Even the lowest price of electricity for cooking is at least about five times that of gas or coal, and even were it equal the working classes would not be enriched by the process. As it is, such uses of electricity merely add to their domestic expenses, and the purchase of all these attractive devices would make a large inroad in a workingman's savings.

In most of the discussions and in all of the assertions as to the value and effect of the Hydro-Electric service, the figures used for illustrative and comparative purposes, are the highest on the scale, namely, those for the smallest domestic service, which, in the operation of commercial service, is naturally and advisedly the highest rate, not only on account of the small amount of usage of each individual connection, and the high proportion of the expenditure required to operate the service and maintain the necessary metering appliances, but on account of its demand coming at the most inconvenient and expensive periods. Such maximum rates apply only to the smallest classes of consumption, and are usually found, even at such figures as 10c. and 15c. per kilowatt hour of use, to be commercially unprofitable except in combination with other local services.

It is found in general practice, that the average cost of the physical connection of a small consumer's premises is from $10 to $30; the installation of meters involves a further expenditure of five or six dollars, and the fixed charges thereon added to cost of inspection of the meter, and of rendering the bills, is known to be not less than fifty cents per month under the most favorable circumstances. The nature of such connections is such that their first cost should be properly paid out of revenue, as they do not offer sufficient permanence to justify being carried on capital account as is being done in the municipal systems. In the case of the small consumer, where very little electricity is used, on account of the small size of the installation, the price necessary to cover these fixed outgoings upon the service must necessarily be relatively high per unit of energy supplied, while it may be and generally is extremely low in total amount. Thus, in large systems in cities, many thousands of consumers will be found whose bills for their service are less than two dollars per month, yet these consumers secure all the advantages of the service to the same degree as the larger consumers, but at a proportionate cost for the small amount of current which they consume.

To reduce the rate or charges to a point which is less than their actual share of the cost of service, means a preferential advantage accorded to them, shifting the burden of expense to another consumer, who is thus made to pay, not only his fair share, but part of that of his neighbor. This is precisely the result which has followed the action of the Hydro-Electric Power Commission, in the establishment of a system of local rates which favors the small domestic consumer to such an extent that such persons are actually paying less for the energy supplied to them than the store-keeper, and less in proportion to their share than the business man or the local industry; all of which are, through their rates, bearing part of the cost of the domestic lighting which is thus being favored at their expense. This may be perhaps justified as an altruistic proposition, but such a solution does not apply to those domestic consumers who can afford to pay for what they receive.

Such a result was, however, a natural outcome of reckless assertion made in bidding for popular support for the governmental system of electrical service, which necessarily involved some later demonstration of the inducements held out to the working classes.

The amount of current actually used for domestic purposes is a minor part of the utilization of electrical energy, but the effect upon the system, as it has been developed by the Hydro-Electric Power Commission, and the municipalities, is always to add to the expenditure to a disproportionate extent.

This can only be understood by some appreciation of the method under which the electrical energy is purchased, both by the Commission and by the municipalities. The amount of power bought is that which is the highest that is used at any time, or what is know as the maximum demand, commonly referred to as the "peak load." This peak is the result of a number of consumers using electricity at the same time, and it naturally follows that the largest number of users combine, at the time when light is thrown on during the evening hours, and the municipal street lighting is in operation at the same time.

Thus, the amount paid for power for a whole month, is brought about usually by the domestic lighting added to the public lighting, and if there be a large number of small consumers all using electricity together in their homes, the result is that the municipality is compelled to purchase an amount of power represented by the use of all these people, without regard to what use can be made of it at any other time during the day. Supposing for instance, that one thousand small consumers should use one horsepower each at the same time, and the municipality should also use 1,000 horsepower in public lighting, then a purchase of 2,000 horsepower for the whole of the current month, and in some cases, for the whole of the current year, would have to be made. There would not be use for the 2,000 horsepower at other hours of the day and night, after the small consumers had turned off their lighting, and the result would be, that even if a number of industries during the day time used part of the power thus purchased, there would be an excessive amount paid for, which would have been brought about by the small consumers.

This is the course which has developed in the operation of the Great Experiment, and in spite of this fact, the small consumer is being asked to pay a less rate than larger users who are helping to utilize the electricity which the small consumers have compelled the municipality to purchase.

As a definite illustration from an official report, in the municipality of Woodstock, an examination of a number of actual payments, showed that dwellings were paying for energy at the rate of less than 5½ cents per kilowatt hour, while business buildings were paying 6½ cents per kilowatt hour.

In the town of Stratford, the proprietor of a newspaper stated that the lighting of his printing establishment cost him 8c. per kilowatt hour, while the lighting in his residence cost him 4 1-10c. per kilowatt hour; and in a published reference to these facts, the local paper suggests that the reason of this inequality in charges is "because there are more votes to be gotten by "giving cheap house lighting than by giving a "moderate rate on power to factories. But the "householder need not imagine that he escapes "so lightly. Collectively, he is the largest rate-"payer, and he pays in the end in his tax bills."

Further, the apparent attractive reduction of the prices for domestic service to such figures as 4c., 3½c. and even 3c., is not really a fair statement of the actual rates obtaining under the Hydro-Electric system, since the system has been ingeniously framed to include what is known as a "floor-space" charge, or a fixed charge, proportioned upon the number of square feet in the residence illuminated. This has the effect of raising the price per kilowatt energy used, to figures much in excess of the apparently low price of the energy. In Woodstock, where the price for domestic energy is 4c. per kilowatt, less 20 per cent., or 3 2-10c. net, the addition of the floor-space charge brings the average price paid in domestic installations, up to 5½ cents per kilowatt hour. In all the municipalities on the Niagara System, the rates including the floor space charge, run from a minimum of 4½ cents per kilowatt hour, to 9½ cents, and in some of the small villages to 10 and 15 cents per k. w. hour.

The result of the establishment of the Government system, has undoubtedly been to increase the domestic use of energy, and this effect has been increased by the agitation and publicity given to the subject of the general use of electricity, but it is to be observed that such uses of power do not increase the public wealth, but rather decrease the private resources of its citizens.

With the exception of such part of the electrical consumption as is substituted for the consumption of fuel, there is no economic return to the community, and as to this element, it can only be said that the art of electrical heating has not advanced to a point of practical competition with the cost of the natural gas and of the oil obtainable in the Province of Ontario.

One evident result of the general adoption of electricity in domestic establishments is an increase in the already widespread habits of domestic wastefulness of electricity, which has been by competent authorities described as the convenience which is more mercilessly wasted than any other. This is particularly the case where the service of electricity has been provided upon the basis of a flat charge for the use of so many lamps or of so much power in motors, without regard to the period of their use, and without the installation of a meter.

As far as the commercial use of electricity is concerned, affecting the interests of the stores and business properties of communities served, there has also been more extensive use of electricity, which is due as much to the activities induced by the commercial competition of private corporations, as to any reduction in price.

In some of the towns upon the Niagara circuit, notably St. Thomas, the cost of commercial service has not been reduced from conditions obtaining prior to the introduction of the Hydro-Electric service; and complaint has been made by the business community of that city, upon this unexpected and disappointing result.

The general result of the Experiment upon the population of the Province, has, therefore, been to increase the general use of electricity, especially among small domestic consumers; to effect a reduction of prior rates of a limited amount, modified by the expenditures involved in securing this reduction by means of competition. The benefit, such as it is, resulting from this reduction, has been secured by a small proportion of the population of the communities served, and the major part of the reduction has accrued to manufacturing interests which originated the scheme of the Experiment, but who have not, as a body, supported the Experiment after they had secured by its means, the reduction in their expenses which they desired. No part of this additional profit in their business has been returned to the community by lower prices or higher wages.

The commercial community is receiving the smallest degree of benefit from the Experiment, and is being made to pay higher rates for its share in the service than the small consumer; the deficiency arising from which class is thus being made up in part by them. Municipal deficiencies in revenue, or profits shown are being made up chiefly by increased payments for municipal light and power service, and the loss upon the Commission's system and the cost of the Commission's operations, is in part being borne by the farmers and other taxpayers of the Province who derive no benefit whatever from the system.

CHAPTER VII

THE APPLICATION OF THE EXPERIMENT

THE main purpose for which the Hydro-Electric Power Commission was established was that of connecting the various municipalities in the Niagara peninsula with a service of electrical energy from the Falls of Niagara, the contemplated consumption of energy in thirty-six of which municipalities was estimated to exceed one hundred thousand horsepower.

The process followed in making these estimates was one which has marked the transactions of the Hyro-Electric Power Commission in its dealings with all the municipalities. It was assumed that the community would not only utilize electrical energy for its own purposes, but would enter into competition in the commercial field for consumers—domestic, business and industrial, with assumed results largely in excess of visible requirements. As a recent instance, the case of the City of Kingston may be cited, for which the estimated consumption of power made by the Hydro-Electric Power Commission ranged from 5,000 to 10,000 horsepower, which amount may be compared with the output of the existing power and light plant belonging to the city, the average of which was about 180 horsepower.

In the little township of Norwich, the Commission estimated that over 400 horsepower would be required. The town contracted for 150 horsepower, and the largest amount it has utilized, up to the present, is 67 horsepower. When the general reduction of rates was made in December, 1912, this little municipality was the only instance in which the price was raised.

In only three instances, viz: Toronto, Berlin and Mitchell out of twenty-seven municipalities, have the contract amounts of power been reached, while in many the demand has been only a small proportion, such as at St. Thomas, where barely forty per cent is used. The highest use in the other instances, to September, 1912, are as follows:—

Town	Contract Amount	Highest monthly use of power to September, 1912	Per cent. of power used to contracted
Guelph	2,500	1,126	45.0
St. Thomas ...	1,500	590	39.3
Stratford	1,000	509	50.9
Galt	1,200	509	42.4
Woodstock	1,200	814	67.8
Ingersoll	500	456	91.2
Waterloo	685	402	58.7
Dundas	600	114	19.0
Preston	600	536	89.3
Brampton	500	335	67.0
St. Marys	500	301	60.2
Tillsonburg ...	500	201	40.2
Hespeler	300	214	71.3
Seaforth	400	371	92.7
Weston	250	87	34.8
New Hamburg.	250	100	40.0
Norwich	150	67	44.6

The result of such over-estimates of the probable power consumption, even in a single municipality, would naturally have some effect upon the whole scheme, but if the process be extended as it has been, then the aggregate over-estimate naturally has a considerable effect upon the proportions of the system and through this upon the expenditures. Thus, exclusive of Toronto, the use in September last, of all the other municipalities, was only 71 per cent. of their contracted totals.

It thus came about that the Commission constructed a transmission system, capable of utilizing upwards of 66,000 horsepower, upon which there has been expended an amount exceeding four millions of dollars. The ambitious total of the original estimate of 113,000 horsepower eventuated in contracts by the various communities for only 30,635 horsepower, and even this amount was found to be so excessive in certain instances, that several communities took advantage of a legislative provision by which they were enabled to write off forty per cent. of their obligation, if they did so prior to July 19, 1909.

The result of these over-estimates has been twofold: In the first place, it has led to the undue expenditure of capital upon the systems, and in the second place, it has committed the participating municipalities to the re-payment of this capital, and to the payment of charges thereon, based on the use of energy in excess of existing requirements. This has involved certain of the communities in further expenditures for providing the means of utilizing the energy contracted for, either by means of increased public expenditures on additional lighting or power, by purchasing electric pumping machinery otherwise unnecessary, or by entering into excessive extensions of distributing systems to reach small consumers in outlying areas, or by indirect losses in inducements to industrial organizations by bonuses and guarantees of their securities, free sites or freedom from taxation. Even these inducements have not always been successful in producing results, and all but one or two of the municipalities have failed to find means of utilizing the full amount of energy for which they were led to contract. Recourse has been made by some municipalities to a large proportionate increase in their own consumption of energy, by extensive enlargements of the street lighting systems, the expense of some part of which has been assessed upon property owners indirectly benefited thereby, and others have gone to the expense of discarding existing pumping machinery and replacing it by electrical pumping machinery, so as to make use of some of the energy in their water services.

If those municipalities which failed to take advantage of the limited opportunity afforded them to reduce their obligations to absorb power, had been held to their bargain by the Commission, their loss would have been serious. As it is, they have not been required to pay for seventy-five per cent. of the amount contracted for, whether used or not, as agreed, but this preferential treatment in part reflects upon the other communities, which have more nearly lived up to their contract obligation, and in part transfers to the Province the burden of the loss.

This has actually been the case with several municipalities, inasmuch as the proportionate amount of power contracted for and not that used is made the basis under the Commission's system, for ascertaining the charges forming the price of power, by an apportionment of the capital cost. Thus, Berlin contracted conservatively for 1,000 horsepower, and has used an average of approximately that amount. Of the estimated original cost of the capital expenditure, it was apportioned 3 7-10 per cent., but apparently in view of the necessity for relieving some of the other communities which have failed to live up to their contracts, this city has been apportioned, in 1912, four and one-half per cent. of the increased amount of capital expended, though it has in no respect failed to carry out its own contractual obligations.

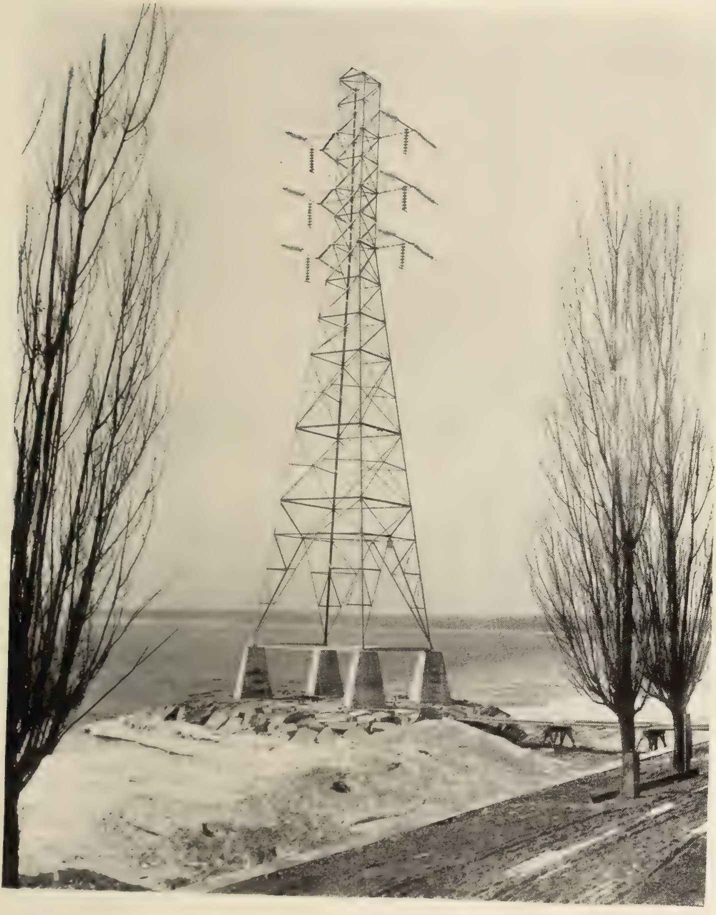
On the other hand, Guelph, which has fallen far short of its contract, utilizing less than a thousand horsepower out of 2,500, has had its apportionment of capital reduced from 9 2-10 per cent. to 4 1-10 per cent., a course apparently forced upon the Commission by the fact that the fixed charges alone on the original apportionment exceeded the agreed price of the power by fifty per cent., and some appearance of making the price approach the cost was desirable if not obligatory.

The methods followed by the Hydro-Electric Power Commission, in making such changes have never been afforded to the public, and even the figures upon which their methods are based, have not been given to the municipalities, nor have they been reported in any public document. The general system followed is, however, disclosed by the original agreements in which the apportionment of this capital cost is utilized for the purpose of determining the price of power, which is to include the repayment and other charges upon the share which the respective municipalities shall pay. These fixed charges include interest and sinking fund, and the same sum is used by the Commission to proportion the share of depreciation and maintenance charges, leaving only the elements of the price of purchased power, and the cost of the operation and administration of the system, to be proportioned upon the actual power used by each individual municipality. The latter are varied without any relation to each other. The result of these methods is to involve communities in payments arbitrarily fixed by the Commission, which vary from the contract to a most remarkable extent.

It is interesting to note that the Chairman of the Commission, in a recent interview, has claimed personal responsibility for the computations, and has stated that he alone makes the rates.

The results when examined appear to be attributable rather to ingenuity than to arithmetic. Thus, according to the Commission's own statement in January, 1913, Toronto used in 1912, 43⅓ per cent. of all the power supplied, but paid fixed charges only on 20 per cent. of the capital, though nearly half the cost of the system was incurred for its benefit, and the most striking fact of all, was charged with only 16 per cent. of the costs of operation and maintenance. London, on the other hand, which used but 11.3 per cent. of the total service, was charged with 15 per cent. of the capital.

The method, as very guardedly outlined by its Chairman, for regulating the charges made by the Commission to municipalities, is a confused process of re-apportionment of capital cost, which is affected by an addition to the total number of consumers, whether municipal or commercial. Thus, if another small municipality be added to the system, an apportionment of capital cost is made to its service, and this is de-



One of the Towers Along the Shore of Lake Ontario. Note the Novel Form of Suspended Insulators.

ducted from the apportionment of those already utilizing the system, unless in the meantime, more capital has been expended. If a commercial consumer is secured, at any price, a sum is taken off some favored town's capital account and an appearance thus made of reducing the burden on the whole system. The process was known to the ancients as robbing Peter to pay Paul.

The original capital expenditure assumed by the municipalities on the Niagara Circuit was $3,801,901, but this has since risen at October 31, 1912, to $4,158,829, with special extra expenditure on Toronto of $183,000. The little villages, and the commercial customers, added to the service, have therefore to carry this amount or more in their prices for power, if the original participators are not to be additionally burdened. The five villages which have been added, comprising a population of 4,359 persons, have been apportioned $136,394 out of $350,000 thus added, or $31 per capita, and their little contracts aggregating 520 horsepower are thus loaded with a capital cost of $260 per horsepower.

To help this situation, the Commission has contracted over the heads of the municipalities with private consumers and corporations, and has applied a portion of the capital cost to their service, so as to relieve the municipalities to that extent. It happens, however, that these services also involve additions to the capital expenditure, consequently the gain is not all in favor of those communities which have already undertaken to bear the capital burden. As to how the additions or modifications so far as made, have been arrived at, there can be no reasonable explanation other than they were dictated by a consideration of the policy in each instance likely to produce the best effect, especially where a community has been, as in the case above quoted, over-burdened with a contract beyond its capacity. Relief is apparently apportioned out at the will of the Hydro-Electric Power Commission, and an examination of the municipal contracts shows that there is no remedy provided for any municipality in this respect, all being compelled to pay whatever the Commission may regard as their "proportionate share."

The effect of these methods of participation are curious when brought together for comparison. Between September, 1911, and September, 1912,

	Increased its power	Its rate has been reduced
Waterloo	43.4%	9.6%
Berlin	41.7%	10.0%
St. Marys	9.4%	22.4%
Hamilton	20.5%	10.6%
Dundas	100.2%	7.7%

When power used is compared with the recent reductions,

								Reduction
Stratford	used	509	h. p.	in	September	and	got	6.2%
Galt	"	509	"	"	"	"	"	12.0%
St. Thomas	"	590	"	"	"	"	"	9.4%
Berlin	"	1139	"	"	"	"	"	10.0%
Guelph	"	1126	"	"	"	"	"	12.0%

Comparing the cash concession with the power used, we find

Stratford	used	509	h. p.	and	got	$1,018	reduction
Galt	"	509	"	"	"	1,527	"
Preston	"	536	"	"	"	1,876	"

The Niagara system has been in operation since September, 1910, or a period of just over two years; during which time the original circle of participating municipalities has been increased by several small townships and police villages, and to them has been added three semipublic institutions, four commercial consumers and two electrical railroads, with some of which the Commission has made contracts direct at prices fixed by itself, and with the stated intention of applying any profit derivable from the sale of energy to these parties, in the reduction of rates to the municipalities. But as the making of a profit from such consumers depends upon the capital assigned to them and the fixed and other charges thereon, the method is somewhat similar to the familiar and ineffective process of hoisting oneself up by the boot straps. For, if the apportionment of capital on such customers be placed at a high level, there would be no profit on their service, while should it be placed low enough to make a good profit, then the rest of the burden is laid on the municipalities.

The method would not present as much difficulty as it does were the prices charged for power ample in all cases, and thus productive of some margin of profit or surplus, which would admit of a flexible treatment being applied; any shortage in which, in certain instances, could thus be covered by the general returns. But this has not been the policy of the Commission, and indeed, it had placed itself before it started upon the work, in the position of operating upon a basis of unduly low prices which have prevailed, and such concessions as have recently been accorded.

The broad results of this policy upon the Niagara System may readily be ascertained by comparison of the fixed charges and costs with the revenue derivable from the power sold at the prices charged. Upon an average use of 25,786 horsepower, on the re-apportionment of capital made after the addition of the villages, institutions and commercial consumers, referred to, the progressive costs show an annual deficiency amounting to $202,897.

This result is based upon the prices charged prior to a reduction announced in October, 1912, which reduction resulted in an increased annual loss upon the same amount of power, bringing it to $231,309.

The effect of a further reduction of rates which was made by the Commission to take effect on November 1st was again to increase this loss, notwithstanding a considerable increase in the use of power, which had developed mainly in Toronto. The effect of this reduction upon an increased rate of use of power to 33,000 horsepower, increased the rate of annual deficiency to $260,000. It cannot be otherwise. The process of excessive reduction of prices accompanying an increase of the product sold, necessarily results in progressive increase of an existing deficiency.

The ascertained shortage is inclusive of all costs and fixed charges, with the suspended sinking fund, the deduction of which, would, however, modify each figure by only $73,278. None of them include the expenses of the Commission.

This financial situation has been concealed from the public partly by the suspension of the sinking fund, and partly by setting aside no provision for depreciation such as the Chairman, in his published testimony, stated was being provided, and by charging costs of operation, administration and maintenance, in part, to capital account. Even if this course could be justified on the ground of the need for relief at the first part of the operation of the system, the reduction of rates which has been made recently could not be justified by the current financial conditions.

In view of the fact that the sinking fund was suspended, and that the public have been assured by the Commission that proper protective provisions were being made out of their payments, the deliberate cutting off in October of part of the annual revenue, and the succeeding reduction in December, resulting in an additional loss in revenue, appears unwarranted. The coincidence of the announcements of reductions with the publication of facts by the City Auditor as to the financial losses of the City of Toronto on its electrical system, is at least indicative of the purpose, having in view also the fact that the major part of both concessions went to that city.

The principle upon which the Experiment was based, namely, that there should be equality of treatment, and that the energy supplied should be charged at cost, and neither above it nor below it, does not appear in the reductions made by the Hydro-Electric Power Commission, in the months of October and December, 1912.

Examinations of the rate of increase in the use of power does not disclose any method by which the reductions as announced, are justified or proportioned, and the only conclusion that can be reached is that they have been arbitrarily and adroitly determined upon a consideration of their effect upon the competition and other conditions existing in certain localities, such as Toronto.

The largest proportion of the benefits thus afforded goes to the City of Toronto, which had already secured the major benefit of the participating scheme and has shouldered the least proportionate share of the burden.

The reductions thus announced, do not involve a sufficient amount to affect beneficially to a material extent the financial results of the various municipal operations served by the Niagara system, but they do have an unfortunate effect upon the financial situation of the Hydro-Electric Power Commission itself, inasmuch as they have reduced its income, in the face of a more extended use of power; thus, the effect of the reduction of rates is cumulative upon the finances of the Commission, and has negatived the improvement which might have resulted to its finances by the increase of the use of power.

In a published statement by the Commission, it was asserted that if the energy consumed by Toronto should increase beyond the amount developed in September, "the Commission would "be unable to justify the charging of more than "$16. This would be ample to pay for the de-"livery of power in Toronto, including interest, "maintenance and operating charges, and would "also take care of the sinking fund, which really "does not start until 1914." They omitted to remind the public that the rate will then be increased one-third.

This statement is not in accordance with the facts, as the cost, without depreciation, of the service of Toronto, upon its present use, is in excess of the present price of $15, the total of all items being $17.86, a loss of $2.86 per horsepower.

It would have appeared reasonable for the Commission to afford some explanation of the effect of the loss of income resulting from the concession to Toronto, and some explanation of the preference shown to that city, but no such explanation was offered, nor any expression as to the result upon the other participating communities.

Toronto, which derived in 1912, from the Niagara system, the benefit of 43.3 per cent. of all the power transmitted, is paying in the charge now established, much less than its due proportion of the capital expenditures, of which it only shares 20 per cent., and yet is paying a price only 80 per cent. of the average. It is not to be wondered at that this has attracted public attention to the favoritism exhibited towards larger communities, at the expense of the smaller, and that the press is beginning to realize and to point out that fully one-half of the length and one-half of the proportions of the Niagara System has been incurred by reason of the service of Toronto, while the share of the cost upon which its rates are based is not one-quarter of the whole.

The terms of the agreement between the Commission and the municipalities, are not being carried out, as the conditions require the municipalities, only

> "(b) To pay annually interest at four per cent. upon a proportionate part of the moneys expended by the Commission on capital account for the construction of the said line,"
>
> "(c) To pay an annual sum to form in thirty years a sinking fund for the retirement of the securities to be issued by the Province of Ontario, for the payment of a proportionate part of the cost of the construction of said line."
>
> "(d) To pay a proportionate part of the line loss, and the cost to operate, maintain, repair, renew and insure the said line."

While the Commission did not obligate itself to abide by the approximate amount of capital stated in each agreement upon which its charges would be based, it nevertheless was evidently the understanding that the shares should be proportioned on the basis of the service secured, because the same wording is applied to the line loss as to the other expenditures. The line loss is a result of the total energy passing and is an index of the quantity taken.

The common response to any remark upon the deficiency in the financial operations of the Commission, is that this will be corrected by a natural process as the volume of business increases.

Thus, in such public statements upon the subject, as that published in the Toronto Press of July 31, 1912, it is asserted that the growth of the use of power will bring about a progressive advantage or gain due to a greater subdivision of the fixed charges. The point was illustrated by stating that a year ago the fixed charges were divided into the cost of 9,000 horsepower, whereas they would gradually be divisible by an increased amount, and that the fixed charges would not have to be increased until there is over 60,000 horsepower in service. The latter statement is not reasonable nor is it in accordance with the facts disclosed by the accounts of the Commission.

The whole assumption is based on a fallacy. An increase of the output of power necessarily involves further capital for additions and extensions. Even upon the rates charged to the municipalities, up to October last, the current deficiency would be modified only to a limited extent, by an increase in the use of energy. If the rates be reduced, as they have been, upon an increased use of power, as the municipalities may have had a right to assume would be the case, then the loss would be and in fact has been proportionately increased. This may be readily seen by comparing the conditions of 1912 with the use, 33,000 horsepower, which may probably be reached in 1913.

The income of the Commission for the fiscal year 1912, was derived from a sale of 21,375 horsepower and produced a revenue of $511,800.

A demonstration of the increase of loss by increasing sales of power, at decreased rates, was afforded by the reduction of rates, which took effect on December 1, 1912. The reductions announced, according to the accompanying list, are, as before, accorded to part of the municipalities, and as in the reductions announced in October, the major benefit accrues to Toronto.

The decrease in the rate of Toronto is 19 per cent. and of the total benefit of the reduction it receives 40 per cent.

The concession was announced as a result of the increased use of power, the aggregate load of municipalities and private corporations being reported as about 33,000 horsepower. This would be an increase over the output in September of 26 per cent., and over the average of the year to October 31, of 51 per cent.

The reductions do not apply to the commercial customers of the Commission, which in September used 2,676 horsepower, nor to sundry small communities such as Tillsonburg, which in September used 421 horsepower, and the village of Norwich which alone is penalized by an increase in its rate of 6½ per cent.

The increase in the consumption is mainly due to Toronto, which has added about 4,000 horsepower to its peak load.

REDUCTION IN RATES—DECEMBER 6, 1912.

Town	Old Rate	New Rate	Per Cent.	Reduction $
Toronto	18.50	15.00	19.	3.50
Hamilton	16.92	16.00	5.4	.92
London	28.00	24.00	14.3	4.00
Berlin	25.00	22.50	10.0	2.50
Guelph	25.00	22.00	12.0	3.00
St. Thomas ...	32.00	29.00	9.4	3.00
Stratford	32.00	30.00	6.2	2.00
Galt	25.00	22.00	12.0	3.00
Woodstock	26.00	23.00	11.5	3.00
Ingersoll	28.00	25.50	9.0	2.50
Waterloo	26.00	23.50	9.6	2.50
Dundas	17.00	16.00	5.9	1.00
Preston	25.00	21.50	14.0	3.50
Brampton	29.00	25.00	14.0	4.00
St. Marys	38.00	29.50	22.3	8.50
Tillsonburg ...	32.00	32.00	—	—
Hespeler	26.00	23.00	11.5	3.00
Seaforth	41.00	40.00	2.4	1.00
Weston	30.00	30.00	—	—
Mitchell	38.00	37.00	2.6	1.00
New Hamburg.	32.00	32.00	—	—
Norwich	30.00	32.00	6.6	2.00
Beachville	33.89	31.00	8.5	2.89
Mimico	30.74	30.00	2.4	.74
Pt. Stanley....	64.00	64.00	—	—
Baden	37.00	37.00	—	—
Waterdown ...	37.50	26.00	30.7	11.50
Pt. Credit	36.79	31.00	13.0	4.79

If the rate of power used in December can be maintained, the price per horsepower to all consumers will be reduced to $19.30, reducing the total revenue to $637,000, or a decline of $155,000.

The cost of power will be	$297,000	
Interest and depreciation	374,000	
Operation, administration and maintenance, as last year plus 50%	153,000	
Sinking fund	75,000	
		$899,000
Deficiency		$262,000

Thus the increase of power by 51 per cent., upon the same capital, with a reduction of price of 19 per cent., increases the deficiency 30 per cent.

There cannot be any other outcome from such financial methods as those pursued by the Commission, than an eventual accumulation of deficiencies, which in a private business, would be classified as bankruptcy. Of course, any such accumulations can be made good by an appropriation from the funds of the Province by which the losses will be transferred to the pockets of the general body of taxpayers. The process has been already in partial operation, in the transfer to capital account of disbursements on operation, maintenance and general expenses.

CHAPTER VIII.

THE COMMISSION'S FIGURES.

THE presentation of its report to the Legislature by the New York State Committee, in January, 1913, followed by its partial publication in the Ontario Press, produced a small tempest of denunciation, coupled with reflections on the accuracy of the Committee's bases of information. These were combined with a re-assertion of faith in the personnel of the Commission, and in the success of their operations, with expressions of wonder that any person could be found hardy enough to doubt these conclusions.

The Chairman of the Commission described the findings of the New York State Committee "as the greatest joke of the age" and their facts and figures as "rot," while the Premier more dignifiedly designated them as being "very extraordinary." The Committee, however, responded that their information was largely derived from the records and accounts of the Commission, which body had neglected or refused to afford answers to inquiries upon the most important points, but which information had come into their possession and had been placed upon their record by others. The Committee quoted certain officials' statements before them, in support of several important details, and the publication of this discussion at last elicited from the Commission a belated financial statement, which, upon examination, was found to confirm the conclusions of the New York State Committee in every important respect.

The methods adopted by the Commission in its guidance of public opinion upon this subject are illustrated in the form of the statement as published, which purports to be a complete summarization of the financial operations of the Niagara System, for the fiscal year 1912. It is so arranged as to present to the public the appearance of very large proportions of operation, the amount of power sold being given in the sums of three months' operations instead of the average of the monthly distribution, and the total is so arranged as to afford the impression that nearly one-quarter of a million of horsepower has been purchased and sold, instead of the actual average of 20,620 horsepower purchased, and 21,375 horsepower sold, during the year.

The statement which was published in the Toronto papers of January 18, 1913, is as follows:

Detailed statement of revenue and expenditure for the fiscal year ended October 31, 1912, issued by the Hydro-Electric Power Commission January 18, 1912:

	H.P.	Amount.
Sum of monthly loads and revenue	256,505.4	$511,801.88
Sum of monthly power loads purchased and costs.............	247,439	456,635.43
Credits	9,066.4	$55,166.45

Power purchased, including losses of transmission and transformation, administration, general expenses, operation, maintenance, and interest:

	H.P.	Amount.
First quarter	53,397	$101,505.49
Second quarter	56,576	108,922.98
Third quarter	58,641	116,693.83
Fourth quarter	78,825	129,513.13
	247,439	$456,635.43

Power delivered including charges for administration, general expenses, operation, maintenance and interest:

	H.P.	Amount.
First quarter	53,149	$108,920.08
Second quarter	58,326.1	117,213.59
Third quarter	64,306.5	127,986.38
Fourth quarter	80,723.8	157,681.83
	256,505.4	$511,801.88

Surplus for the year, $55,166.45.

OPERATING EXPENSES.

Details of operating expenses:

Power purchased, including losses of transmission and transformation:

	H.P.	Amount.
First quarter	53,397	$41,827.65
Second quarter	56,576	44,317.87
Third quarter	58,641	45,935.45
Fourth quarter	78,825	60,783.29
	247,439	$192,864.26

	Maintenance and operation costs.	Interest.	Totals.
1st quarter	$21,966.82	$37,711.02	$101,505.49
2nd quarter	26,476.50	38,128.61	108,922.98
3rd quarter	31,405.89	39,351.49	116,693.83
4th quarter	29,164.35	39,565.49	129,513.13
	$109,014.56	$154,756.61	$456,635.43

The operating expenditures are further detailed as follows:

Operators' salaries and expenses and operating supplies	$48,916.06
Maintenance of transformer stations and transmission lines	38,979.42
Administration and general office expenses	21,119.08
	$109,014.56

This statement shows that the revenue for the year was derived from an average sale price of $24.00 per horsepower, agreeing exactly with the findings of the New York State Committee. The amount of power sold is closely in accord with the statements of that Committee.

Upon the year's operation, a surplus is shown of $55,166.45. The disbursements accounted for by the Commission thus amount to $456,635.43, covering the cost of power, of operation, maintenance, administration and expenses, as well as the interest on capital, but including no provision of depreciation or for sinking fund. As interest and the purchase price of power are readily ascertainable, the chief items of interest are those for operation, maintenance and administration, and the total of these is given as $109,014.56.

An examination of the monthly accounts of the Hydro-Electric Power Commission has disclosed the fact that during the six months from December 1, 1911, to May 31, 1912, there was disbursed upon the three foregoing items a total of $188,508, which covered only one-half of the fiscal year. These items appear on accounts audited by the advising auditor of the Commission and are in detail as follows:

	Operation	Maintenance	General Expenses	Administration
At Dec. 30, 1911....	$8,774.76	$7,269.32	$75,324.14	Nothing shown
At Jan. 31, 1912....	12,678.17	9,391.04	13,613.21	
At Feb. 29, 1912....	18,690.02	11,370.89	3,409.67	
At Mar. 31, 1912....	26,244.19	16,588.33	7,873.38	
At Apr. 30, 1912....	31,333.59	20,688.95	14,675.57	
At May 31, 1912....	41,689.99	27,761.73	4,712.60	

It appears from this information that the items accounted for in the statement of the Commission do not cover the whole of the real disbursements. There appears to be some method by which a part of the cost of operation, maintenance and general expense, upon the system, is dispersed into the cost of new construction.

The Commission's account "Detail of expenditure to May 31st, 1912," shows that these three items then amounted to $74,000, and comparing this account with the recent statement of capital expenditures at the 31st of October, 1912, it is found that the capital cost of the system has been increased by a sum somewhat in excess of these three accounts, indicating that the difference between the expenditures accounted for and those actually incurred, has been carried into the costs of construction.

But even assuming the accuracy of the expenditures accounted for, the statement is found to confirm the findings of the New York State Committee, as, with the addition of depreciation and the sinking fund charges, the net deficiency upon the operations of the Niagara System, as published by the Commission, is somewhat in excess of that stated by the New York State Committee. Adding to the figures now made public by the Commission, the items for depreciation and sinking fund, the total liabilities become $719,720; the revenue for the year being $511,-

801, leaves a deficiency of $207,920, which is $5,000 more than that which was shown upon the records of the New York State Legislative Committee, which was $202,897.

The report of the New York State Legislative Committee drew particular attention to the large proportion of the total deficiency which resulted from the service of the City of Toronto, and pointed out that the reduction in the rate to this City, which was the largest consumer of energy, was productive of a dis-proportionate amount of loss upon the whole operation of the system. This criticism drew from the Hydro-Electric Power Commission a further financial statement, showing the results of its operations with the City of Toronto during the same period, which also proved a remarkable confirmation of the information made public by the New York Committee. The Commission showed that the average sale of power to the City of Toronto during the year ending October 31, 1912, was 9,100 horsepower, which was 43 1-3 per cent. of all the power supplied upon the system. The proportion of the capital cost of the System upon which the fixed charges to the City of Toronto were based, was $857,000, which is within $20,000 of the figure adopted as the average condition, in the New York State Report. To this of course, is now to be added the sum of $183,000 which the Commission has agreed to carry upon the Provincial account, being a proportion of its expenditures upon the work of constructing a connection through the City of Toronto, the total cost of which exceeded $260,000. The municipal authorities disputed the payment and an agreement was reached by which the larger part of the expenditure has been transferred to the accounts of the Province.

The total expenditures accounted for by the Commission in respect of the service of the City of Toronto, amount to $137,080. Out of this expenditure, the two major items are readily ascertained, being the cost of the power and the payment of interest upon the capitalization apportioned. These two items aggregate $119,821, leaving for maintenance, operation, administration and general expenses, the pitiful sum of $17,259.

If the statement issued by the Commission had been prepared so that this result would have been made clear to the public, it does not seem probable that many of those who read the statement and congratulated themselves upon its favorable showing, would have had much faith in its accuracy. If the City of Toronto, using 43 1-3 per cent. of all the power transmitted, contributes only $17,259 to the annual expenditure of $109,014, or less than 16 per cent. of the total, there must be something radically wrong with the methods of distribution of costs in the accounts of the Commission, and a clear failure to comply with the terms of the participating agreement, which states that each participant shall pay a proportionate part of the operating charges and costs and loss of power. The service to the City of Toronto, upon the proper proportion of these costs, will be found to have cost the Commission, inclusive of all fixed charges, without the sinking fund, $23, for which the City has been paying only $18.50. As the New York State Committee ascertained the costs, they were, with the sinking fund included,

$24 per horsepower. As now disclosed by the Commission, they stand as follows:

Service of Toronto—9,100 horsepower.

Cost of power	$9.40
Interest	3.77
Depreciation	4.71
43⅓% of operation and other charges	5.15
Sinking fund	1.70
Total, per horsepower	$24.73

One of the minor features upon which the Chairman of the Commission has congratulated himself, and of which he has made use as an illustration of the beneficial workings of the system, is the fact that the developed maximum demands of the various municipalities are greater than the maximum power purchased from the Ontario Power Company, which varies from the total of the several developed demands, on account of what is technically known as the "diversity factor," or effect of the combination of maximum demands, the various municipalities highest demands failing to coincide as to time with each other.

This results in a maximum at Niagara, which is usually somewhat less than the aggregate of all the highest demands of the various municipalities, upon which their charges are based. The result is similar to that experienced in general central station service, and the extent of the difference is a variable quantity which changes with the season of the year, and with the character of the use of electricity at the point of maximum demand.

The difference for the whole year, as to which the Hon. Adam Beck has so frequently referred in congratulatory terms, thus turns out to be only 755 H. P. or 3½ per cent. of the power, the monetary value of which was $7,097, or 1 4-10 per cent. of the revenue. This more than confirms the view expressed as to the relatively small effect of the "diversity factor" on this system.

Reference has been made to contracts made by the Commission direct with commercial and other consumers not of the nature of municipalities. The total contracts made in this manner, aggregated 2,825 horsepower.

The adjustment of capital expenditure made by the Commission upon these services, consists in part of actual cost involved in their service and in part of the adjustment of capital expenditures upon the whole system; thus, the London and Hamilton Asylums and the Agricultural College, which are semi-public institutions, are charged with a capital expenditure amounting to $48,151, upon a use of about 250 horsepower, or about $190 per horsepower; upon which basis, it may be assumed that their prices for services are ascertained, though it cannot be said that the prices now being charged cover the whole of the costs based upon this apportionment.

In the case of the commercial consumers, the service of the Port Credit Brick Company, which is a private corporation, is apportioned $126,000, or approximately $160 per horsepower, which appears to be an extremely excessive capitalization of the power machinery of such a class of industry, and may be compared with the apportionment of the City of St. Thomas, exceeding $270,000 for the same amount of service.

It must be borne in mind that the canvassing, estimating and other costs incidental to securing this class of business, has been paid for by the funds of the Provincial Government.

In any event, as no profit accrues to the Commission from its operations at Ottawa, the Big Chute or at Port Arthur, but rather some small loss; the total annual deficiency upon the financial operations of the Hydro-Electric Power Commission now involve about a quarter of a million dollars, part of which is at present being met from the Provincial treasury and part is being carried as capital expenditure under the bookkeeping methods of the Commission.

CHAPTER IX.

OPERATION OF THE NIAGARA SYSTEM.

THE financial entanglements resulting from the operations of the Niagara system, which have been so recently confirmed by the Commission's belated figures, have been brought about mainly by underestimate of costs, combined with overestimates as of the probable use and cost of the service, and by the expenditure of capital upon an expensive system of transmission, of which a limited use is made, and the cost of which has included operating losses charged to capital account. That the capital thus expended has been laid out upon excellent materials and upon a design of the highest merit as a mechanical and electrical system, is the best feature of the situation.

The caution which should have accompanied the embarkation of the capital of the people of Ontario in so novel and untried a scheme, as a combination of services of diverse character, scattered over a wide area of country, has been conspicuously lacking in the methods employed. Such a result might be expected in the handling of a problem of such magnitude and technicality by men who, however enthusiastic and devoted, were unacquainted with the technical and financial problems which had to be met.

The outcome of the expenditure which has been made is not entirely satisfactory, because it is not entirely complete. It has been noted that the capital of upwards of four millions of dollars, has provided only a transmission and a partial transforming system, and does not include the public ownership of the Hydro-Electrical development which was one of the original ideas for which the Experiment was undertaken. Nor does it include any provision for emergency or reserve appliances, such as is now known to be necessary accompaniments in connection with the operation of transmission systems.

The physical work upon theNiagara transmission system commands appreciation of the excellent design, workmanship and materials employed, especially upon the high tension trans-

P. W. SOTHMAN.

A. I. E. E.

The Designer and Constructor of the Niagara Transmission System.

mission lines. It is probably the finest in design and construction hitherto put in service, reflecting the skill and ability of its designer, Mr. P. W. Sothman, the Chief Engineer of the Commission. The system has been specially designed with a view to the avoidance of liability to failures and interruptions by lightning, and special precautions have been provided to protect the system from the effects of severe wind storms.

It is no reflection upon these features to record that, notwithstanding such precautions, interruptions have occurred upon the system, as is only natural upon an exposed system covering several hundred miles of country. This fact has been ignored in all published statements, while on the other hand, interruptions to other lines of transmission in the hands of private companies, have been made the subject of head-line articles in the press, accompanied by statements severely reflecting upon the design and construction of privately owned systems, comparing their value and security unfavorably with that of the Hydro-Electric Power Commission.

As a conspicuous instance of mis-information thus spread abroad, a reference may be made to the partisan publication of the New York State Conservation Commission, in which the following statement occurrs:

"In the system built and operated by the Hydro-Electric Power Commission, there has been "an interruption of not to exceed thirty seconds "during that time," the period referred to being that of its existence.

This statement was based upon no ascertained information, and is contrary to the facts. The Hydro-Electric Power Commission has kept a record of interruptions upon its Niagara system, occurring between November, 1910, and the end of May, 1912, out of which forty-four affected the entire system and the average time being 7 4-10 minutes per interruption. One interruption of an accidental character, affected service to the City of Toronto for a total period of time closely approximating a serious interruption of the Electrical Development Company's transmission system, which on July 5, 1912, was interrupted for upwards of five hours, of which unfortunate occurrence the newspapers of Toronto made considerable use, to the disadvantage of privately owned transmission systems.

It is noticeable on the other hand that interruptions, one of which occurred a few days later upon the Hydro-Electric System, received no mention whatever in the leading papers of Toronto.

The longest interruption upon the Hydro-Electric system, exclusive of that already referred to, took place, curiously enough, exactly one year prior to the occurrence upon the Electrical Development system, when an interruption of the Niagara system took place for a period of two hours and a quarter. The liabilities of all transmission systems to such occurrences are very similar, and all indicate the desirability of re-inforcement of such systems by steam reserve plants.

These facts not only serve to illustrate the attitude of those who have had the opportunity of informing the public on the facts with regard to the Experiment and have failed to do so, but also strongly illustrate the necessity which exists for the provision upon the Niagara system of reserves or emergency steam plants such as those which have been found desirable and necessary under other conditions and in other localities. Numerous opinions of the best authorities could be adduced in support of this point, and a strong illustration of its desirability exists in the recorded mishaps to the Commission's fine system.

A number of minor failures have occurred in municipal systems connected to the Niagara service, although several of these municipalities have been in possession of steam or other power plants, which could have been utilized with advantage as reserves or emergency plants, but do not seem to have been kept in operating condition.

It seems inevitable that if the system is to be maintained, as time proceeds and its age increases, in completely reliable service, the Commission will be compelled to construct reserve plants, largely adding to the capital cost of the system, or that the Commission will find it necessary to supplement the service purchased from a single source, by emergency contracts with other sources of service or what is known as "stand-by provision," which would of course add to the annual cost of operation. Failing in such provision, the municipalities will find themselves confronted with the problem of maintenance of service.

In analyzing the financial conditions the item of depreciation appears, among the fixed charges. The question of depreciation on so large a system as that of the Niagara circuit is one of great importance, and one which naturally affects to a substantial extent the balance between expenditures and revenue. The question extends beyond the system of transmission into the distributing systems of the various municipalities which are dependent upon the main system. In some references to this subject, the statement has been advanced that no such provision is required, because the amortization of the bonds will wipe out the capital expenditure within the life of the issue. But in view of the fact that these bonds have been issued for a period of thirty years, it must be evident to any person acquainted with the physical deterioration of electrical apparatus, together with the rapid changes taking place in electrical methods and systems, that such a length of life cannot be assumed for modern electrical apparatus; particularly for such parts of systems as may be exposed to exterior conditions or subjected to continuous usage, and therefore the life of such systems cannot be assumed to much exceed fifteen years, without radical reconstruction, or substitution of new apparatus.

While it is true that the transmission system of the Hydro-Electric Commission has been constructed in a superior manner, with unusual features, designed for security and permanence, it nevertheless remains the fact that the changes in the methods of utilization of any such system will most probably bring about a necessity for reconstruction within a moderate period of time, far less than thirty years. The Commission has so far recognized this fact, as to include, according to its published statements, an item of 2½% upon capitalized investment, as a depreciation charge upon its service, which in other cases it has raised to 4½% per cent. It does not appear, however, from a consideration of the conditions that such a rate as 2½% is sufficient, since it would assume, at the compounding rate of 4%, a life of twenty-four years, which, in the present state of the art, cannot be considered a suitable period and is not so regarded by the best authorities upon the subject. The Chairman stated that the depreciation to be provided in the price of power is "running from 2 to 5 per cent.," while the present acting chief engineer of the Commission testified that it should be approximately 7½%.

Part of the capital expenditure of the Niagara System, for instance, has been upon lines of wooden poles, the life of which is short. Part consists of transformer stations, containing complex appliances, peculiarly liable to injury and deterioration and further subject to considerable changes as the advance of the art proceeds.

As regards the right-of-way, the Hydro-Electric Commission purchased only an easement which will require to be renewed at a later date, and the provision for which must be made. In this connection, it is also to be noted that the construction of other public improvements, such as railways paralleling transmission systems, may require some re-alignment of the system, which may justify the policy of acquiring only an easement for the right-of-way. Prevailing practice in these matters has established percentages to be set aside for the purpose of depreciation in a number of existing instances, and by a variety of authorities.

The period of existence of the various parts of the Transmission System no doubt will vary, and therefore a rate of depreciation on each item may be properly applied, proportioned on the expected period of physical or effective commercial existence. Some parts of such a system would, no doubt, last in a physical sense longer than their economical use would be warranted, and a change, possibly a complete reconstruction, such as has developed in similar materials or constructions, will be required long before the actual material is worn out or decayed, and long before the repayment of the bonds has been completed. Then, also, changes in methods involve extensive changes of construction in complex systems, where one part is designed to serve another. The need of an ample fund for depreciation is therefore generally recognized, and is, in fact enforced upon private corporations, and the best method of ascertaining a rate, is to apply the results of past experience to the probable life of each large element in a combined system.

Following this process on the Niagara System, the results are as follows; the rates applied being based on the compounding of interest at the rate of 4% per annum.

The result clearly shows that the average rate should be five per cent.

Equipment	Cost	Life	Rate of Depreciation
Steel Tower Lines...	$1,538,000	18 yrs.	4%
Telephone lines.....	130,000	10 yrs.	8.33%
Relay System.......	55,000	12 yrs.	6.7%
Conduits and cables..	41,000	18 yrs.	4.0%
Wood Pole Lines...	493,000	10 yrs.	8.33%
Right of Way......	542,000	30 yrs.	1.8%
Transformers and Distribution stations	1,360,000	14 yrs.	5.5%

Average of all—is five per cent.

It is to be borne in mind that the greater part of these have already been in existence for two and some for three years and that no depreciation fund has as yet been provided.

That portion of the transmission system which is of the most permanent and substantial character is naturally the main line of transmission, and the portion which is of the least degree of permanency, being exposed to a maximum degree of physical depreciation, consists of the cheaper class of extensions of the system. This is the portion which has formed and will form the means of further extension of the service of the Commission's system, and is largely composed of light pole lines extended to small village communities beyond the radius of municipalities already upon the system.

The Commission has announced that its activities will be directed towards some extension of the Niagara service into country districts for the benefit of the farming communities therein. The Chairman of the Commission, accompanied by his Chief Engineer, went to Germany, and investigated the use of electricity in farming districts. The Commission recently prepared a demonstrating plant of small farm appliances; and started these appliances upon a tour of exhibition in country districts with the idea of interesting the proprietors of farms in the wonders and uses of electricity.

In various publications and before public audiences Mr. Beck has held out most alluring statements as to the value of electrical service to the farming communities; and has stated that energy would be sold by the Commission to farmers at the rate of $2 per horsepower per month, or $24 per annum, a price it may be noted, much less than that which is being charged to many of the communities in the participating agreement.

But before the New York State Legislative Committee he admitted that "if we have to build "such lines especially for the farmers it would "not be feasible," and thus limited the scheme to such farms as lie along the line of the transmission system.

This limitation leaves the matter very much where it now stands, as the bulk of the farming population would still be unable to utilize any of the possible advantages of the Government system for which they are paying part.

It is to be noted in this connection that the census returns of the Province of Ontario for the year 1911, exhibit a general decline in the agricultural population of the forty-three counties of the Province; a result which is due to the fact that the development of the land has already proceeded to a point at which an increase of population is of little commercial advantage, while the opening up of the western part of Canada, with the attraction of its high wages, has drawn away a certain proportion of the population of the older and more settled portion. The decrease, which does not fully exhibit the actual effects, as it includes the natural increase of the population during the ten years, is 8.4 per cent.

Now the introduction of electricity for the purpose of improving the conditions of farming communities may be a well-timed proposition, from the point of attracting the attention of farmers who may become dissatisfied with the present situation, but it is as in other directions surrounded by limitations of a practical, financial and economic character which should be carefully weighed before accepting the proposition.

The scheme which the Commission has propounded depends upon the combination of a certain number of farmers in a district applying for a fixed amount of power to the Commission, and as the distances to be covered by any extensions would be considerable between each small consumer, it is probable that the cost will be found to bear a high relation to the amount of power utilizable.

The introduction of electrical service throughout farming areas, introduces merely another form of power operation for farming purposes, especially in the mixed class of farming conducted in this part of the country, which are now largely performed by gasoline engines; and also to a considerable extent by hand or horse power. As to the latter, it is to be noted that the raising of horses is one of the most profitable features in mixed farming in the Niagara peninsula at the present time, and as to the use of a different form of power for other purposes, it would appear that the only large matter in which power is required would be in the operation of ploughing, reaping and binding machinery, to which purposes electricity has not so far been adapted. The purposes, therefore, to which electricity could be applied upon the farms of Ontario, would chiefly consist in such minor details as the operation of milk separators, and such intermittent operations as threshing, feed cutting, and possibly, milking devices.

The use of electrical devices for such purposes as the latter, is a refinement in the nature of a convenience, rather than a practical necessity. So far as the operation of threshing is concerned, the entire output of a farm calls for a use of power for this purpose for only a very restricted period after the harvesting of the crop, and in the case of the counties of agricultural Ontario, the mixed farming conducted, reduces the amount of grain to only a moderate proportion of the total products of the area.

The introduction of electric service to the farmers therefore, involves the cost of a supply based on a maximum demand very largely in excess of the average. The use of this current is certain to be extremely intermittent and erratic, and thus a disproportionate capital cost is involved in the project.

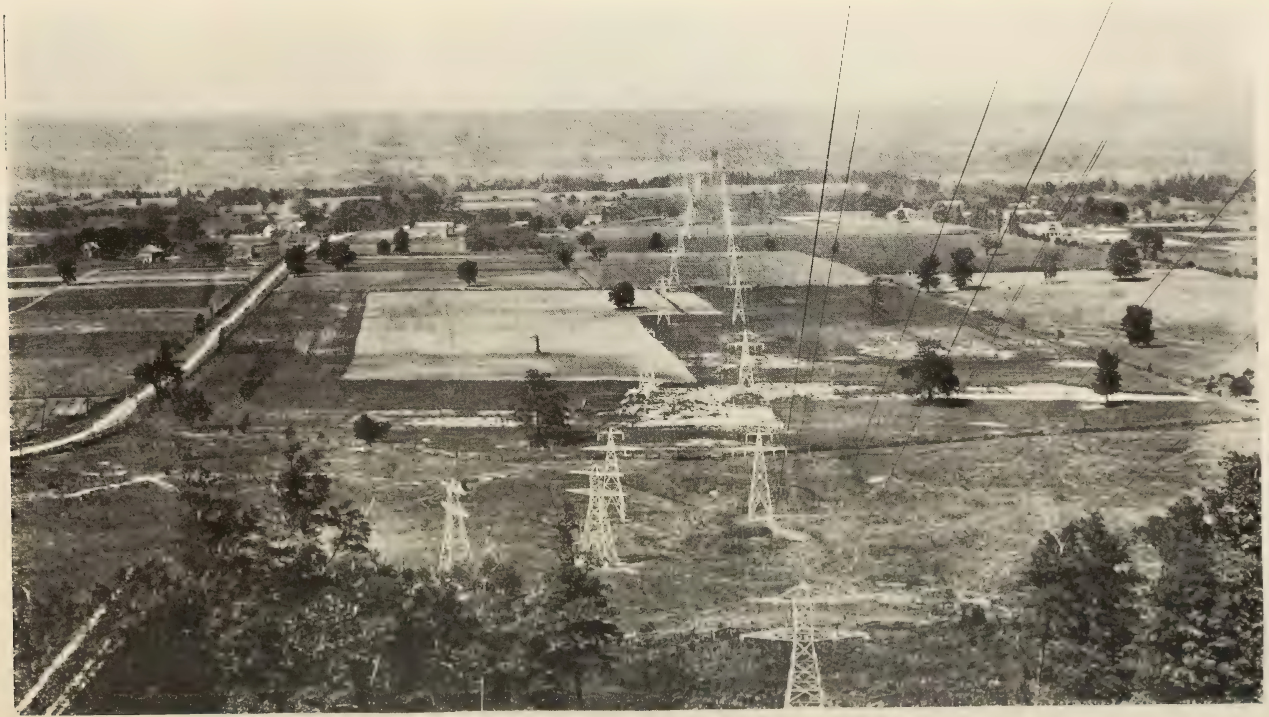
Even at the price which has been publicly held out as an inducement to farmers, namely, Two Dollars per horsepower per month, if economically justified, the farmer would be involved in additional expenditures of capital account for distribution and control systems upon his property; and further, for the purchase of electrical motors suited to the operation of the varying appliances of a mechanical nature.

Assuming that a motor of a portable character is purchased by him, such a machine would have to be of sufficient capacity to operate the largest of such appliances, probably capable of operating a threshing machine. To apply such a machine to a minor apparatus, such as a feed cutter, would mean operating it at very low efficiency or waste of power. It would therefore, probably follow that any farm having mixed operations, would require a series of such motors, the cost, upkeep and eventual replacement of which would come directly upon the farmer.

If in addition to this, the farmer already possesses power in some other form, his expenditures thereon would be rendered useless by the adoption of a new system of power. While, therefore, the use of power upon these farming areas is interesting, and in some cases may prove desirable, it cannot be regarded, excepting to a probably limited extent, as an economic advantage to the agricultural production of the district.

The convenience of electric lighting in farm dwellings is not in the nature of an economic gain, but involves the farming population in an additional form of personal expenditure. If the development of the use of electrical energy for the stimulation of crops were a practical feature, the extension of the Niagara System into the farming districts of central Ontario might be of direct economic advantage to the community, provided that such an application could be adapted to the variable forms of crops which are raised in this part of Canada.

The fact that practical use of electrical service has been made in certain farm districts in Ger-



The High Tension Transmission Line Across the Dundas Valley near Hamilton.

many to a considerable extent, is not conclusive demonstration that the same conditions would apply in Ontario, where the distances to be traversed are greater, and where the conditions are undoubtedly extremely dissimilar. It is possible that in the limited areas through which the lines of transmission necessarily pass that portion of the farming population residing in the immediate vicinity of the lines might be economically served, provided that such service does not involve anyone but themselves in unnecessary capital expenditure.

If the development of electricity for the purpose of farming should be found to increase the productiveness of agricultural districts, it will undoubtedly have to be accomplished by the use of private or public funds to finance the operations of the individual farmer. Such a course might form a legitimate part of the activities of a private corporation, but the use of general public funds for such a purpose would appear to be an extremely doubtful proposition, particularly as the benefits thus conferred would necessarily be unevenly distributed, both on account of the locality of farms as regards electrical service, and as regards the extent of the practical use to which such a service could be put.

Whichever way this phase of the matter is turned, it appears to the disadvantage of the general rural population, who must more or less be made to contribute to the convenience of other persons without any share therein. This result is a natural outcome of the expenditure of Governmental credit and funds upon a utility of the nature of electricity, which is not utilizable by all the people.

CHAPTER X.

THE CITY OF OTTAWA.

THE story of the operation of the Hydro-Electric Power Commission would not be entirely complete without a description of its work in connection with the three other limited systems upon which it has exercised its activities, in addition to that of the Niagara System, as these consist of contracts for the purchase of power from private corporations, in manner very similar to the arrangements now existing between the Commission and the Ontario Power Company at Niagara.

The Commission has, in the three instances now referred to, resold the power thus purchased to the communities served, also in similar manner to that prevailing under the participating contracts upon the Niagara circuit. There are, however, in each of the three lesser instances, circumstances which are of peculiar interest, brought about by local conditions, but illustrative, to a remarkable extent, of the methods which have been pursued by the Hydro-Electric Power Commission in its dealings with municipalities and corporations.

The first operation in which the Commission took action was in the case of the City of Ottawa, in which, long prior to the establishment of the Commission, an agitation had been in existence looking towards the establishment of a municipal ownership and operation of electrical services.

The City of Ottawa had, about the year 1901, granted a franchise to a corporation known as the Consumers Electric Company, the purpose of which was to endeavor to secure a part of the business at that time in the hands of the Ottawa Electric Company, a corporation which had been engaged, for seven years prior to that date, and also under franchise given by the City of Ottawa, in the manufacture of electrical energy.

Prior to the organization of the Consumers Electric Company, the Ottawa Electric Company had, without the effects of competition, gradually reduced its rates from a maximum for small domestic service of 20 cents less 20% or net 16 cents, to a rate which was in existence at the time named, of 12 cents less 20% discount, or net 9.6 cents. It must here be noted that the Chairman of the Hydro-Electric Power Commission, and others, have, in public statements, alleged that at the time of the establishment of municipal operation which followed the eventual failure of the Consumers Electric Company, the rates in Ottawa were 15 cents and that the reduction which took place from this alleged figure was due to the establishment of municipal ownership and operation. Such, however, was not the case, as the rate had already been reduced prior to the commencement of operations of the competing company, the effect of which competition was further to reduce the maximum rate from its then figure of 9.6 cents to 7.2 cents net on domestic service.

The Consumers Electric Company proved a financial failure, and about the time of the organization of the Hydro-Electric Power Commission, this corporation had become so involved that its property was offered to the Ottawa Electric Company, and a bill was introduced in the Dominion Parliament to authorize the purchase of its capital stock by the Ottawa Electric Company. A campaign of agitation was started in opposition to this amalgamation, which was largely fomented by the press in the City of Ottawa, and was extended by them into an advocacy of the municipal acquisition of the Consumers Electric Company's property and its operation as a municipal system. Considerable exaggerations were indulged in at this time as to the value of this procedure to the City and it was stated that if the proposed amalgamation should be effected, the consumers of electric light and power would find their rates increased by $200,000 a year. As the total gross revenue of the Consumers Company during its last year of operation was only $35,207, it will be readily seen that this figure was a considerable exaggeration of possible results due to the cessation of its operation. In spite of the fact that this corporation's business was bringing in no profit and not even sufficient receipts to pay interest on the capital invested, the municipality was induced to purchase the company's property at the price of $200,000 and at this cost took over a system which consisted merely of an over-head distributing system of pole lines, which had not been maintained in a proper manner, so that the municipality was immediately involved in a very considerable increase of its investment in order to put the system into a better condition. In taking over this system, the city accepted the burden of operation of a business which was already proven to be a failure and in which it was evident that the rates, to bring in a reasonable return upon the capital investment, required to be raised, and as a matter of fact, upon the acquisition of the system, the City's first action was to cancel hundreds of existing contracts which were of an unprofitable nature.

During the progress of this agitation, it does not appear that any effort was made, nor any suggestions advanced as to arriving at an understanding with the Ottawa Electric Company for a satisfactory system of the regulation of rates; rather than the investment of municipal funds in the field of operation.

The system thus purchased, included no power development, the Consumers Company having purchased its supply from one of the corporations owning hydro-electric developments upon the Ottawa River, and in the course of the opposition which developed to the municipal course of action, a suit was entered opposing the purchase of power by the City from a power company, on the ground that the charter of the City gave the City no right to make such an agreement in view of the franchise already existing. The courts decided against the City in this suit, so that the City of Ottawa was left in the position of having purchased a transmission system without power to secure a service of energy.

It was at this time that the Hydro-Electric Power Commission came into possession of its legislative authority and stepped into the breach thus existing, and by making a contract for the purchase of necessary power from the Hull Power Company and re-contracting its sale to the municipality, the Commission enabled the

City to secure the service which had been denied to it by the courts.

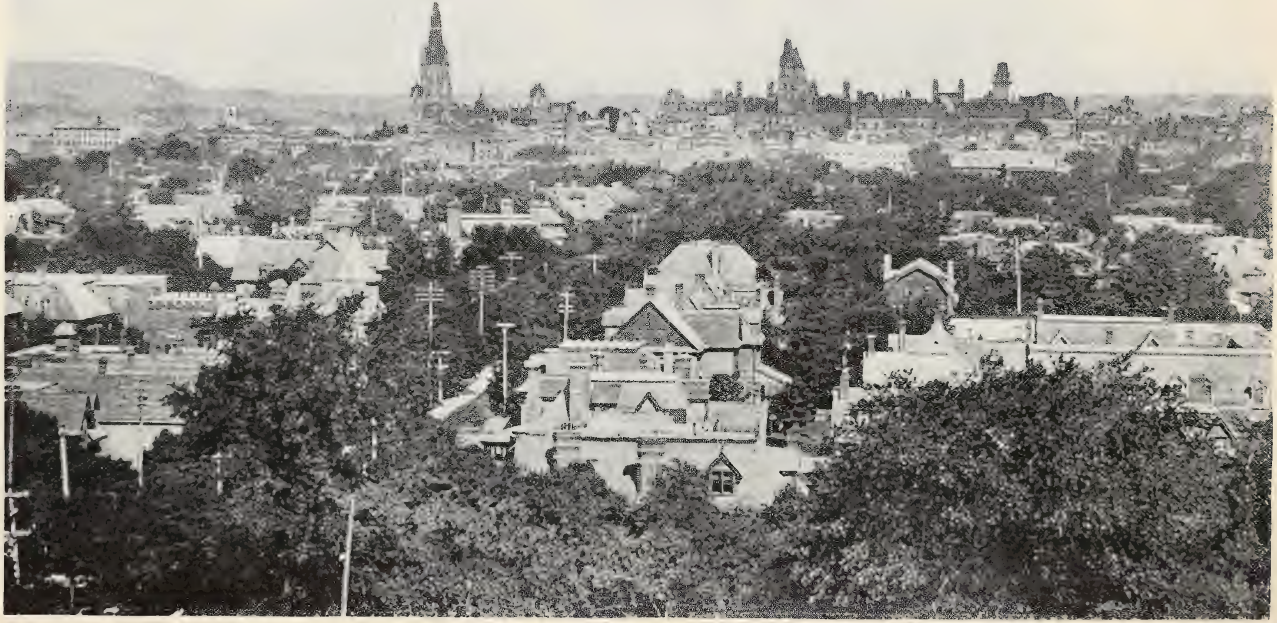
At the time that this system thus came into operation, the lighting of the streets of Ottawa was under contract with the Ottawa Electric Company, and the City had recently made a new contract for a period of ten years, at the price of $52 per arc light per annum for all night lighting. This contract included a clause empowering the City to cancel the agreement by giving two years' notice, although the basis of price, which was a reduction from prior existing rates, had been agreed upon the assumption of ten years' operation. The municipality, however, exercised this option, cancelled the contract, and took over the arc lamp system from the Ottawa Electric Company at a price of $30,000. The lamps thus acquired were of the direct-current enclosed-arc pattern, and in connection with their operation, under the contract referred to, the Company had purchased and installed special direct-current generating machinery which the City declined to include in the purchase and left upon the hands of the Company, and was sold at less than a quarter of its original cost. The lamps which the City thus took over became useless to them, although they were in excellent working condition, and were entirely discarded, as the municipality possessed no machinery capable of their operation. In their place, a complete new system of alternating current lamps was installed at a substantial addition to the expenditure of the City, which thus practically paid twice over for its arc lamp installation.

As already mentioned, in entering upon the municipal operation, the first action of the City authorities was to cancel a large number of existing contracts, and upon examination of the then existing rates, the municipal officials decided that the rates then in existence must be maintained. There seems to have been some understanding between these officials and representatives of the Ottawa Electric Company, whereby neither party would, without notice to the other, make further reduction of the rates then existing. Both systems continued, therefore, to operate at the existing rates with practically no change until the month of November, 1911, when the municipal representatives opened the question of a reduction of rates and apparently agreed to confer with the Electric Company upon the subject. While the matter was pending, the members of the Municipal Electrical Commission visited the Hydro-Electric Power Commission, in the City of Toronto, and as a result of their conference with the Commission, announced a reduction of the rates and a change in the methods of applying the rates, without reference to the Ottawa Electric Company.

The operations of the Ottawa Municipal Electrical Commission have been published in annual reports which have shown for several years ostensible net profits. A careful examination of the methods employed in operating the municipal system, indicates the same process as in the case of several of the municipalities upon the Niagara circuit, of charging the municipality for its own services of street and other lighting, a price which is productive of some, if not all, of the profit shown upon the annual operation. The annual statements, upon a careful expert examination, show several elements which indicate that the financial results are far from being as satisfactory as the apparent net profit would seem to indicate. The amounts which have been shown as a surplus or profit have been carried by the Municipal Electrical Commission to a depreciation fund, the necessity for which is recognized by the Commission in this manner, and is certainly apparent upon a system consisting exclusively of pole lines and house connections. The profits, such as they appear, have, however, been so variable, that in two years they amounted only to less than one-third of one per cent. upon the debentures issued by the City for its electrical investment, and in one year the total amount thus set aside was $81.

The City has expended upon its system approximately $500,000 of capital investment, bearing interest at the rate of 4% and properly carrying a sinking fund at the rate of 1.8%. There has appeared, in the several accounts of the Commission, an item carried over from one year to another of "accounts rendered but un-"paid," which, from a total of approximately

The Beautiful City of Ottawa.



Municipal Pole Lines Aiding to Disfigure the Capital of Canada.

$15,000 at the end of 1908 has increased to nearly $42,000 at the end of 1911. The Municipal accounts afford no information as to the nature of this unpaid revenue, but inquiry within the City elicited the fact that a considerable part of this amount consists of doubtful and bad debts. The increase in this direction is apparently due to the nature of the services which have been attracted to the municipal system, consisting mainly of the smallest class of lighting consumers, of whom quite a number were taken from the system of the local company at the time of the commencement of municipal operation, these having been in arrears with the Company, forsaking their system for that of the municipality at the earliest opportunity.

Much competition has existed between the two systems in the City during the six years of their parallel operation, and a substantial advantage has lain with the municipal system on account of an agreement which the municipality secured when making its franchise by-law with the Ottawa Electric Company. This agreement enables the municipality to utilize the poles of the

Ottawa Electric Company for the purpose of carrying the municipal wires, by which means it becomes cheap and easy for the municipality to extend its services into the outlying districts, so soon as the Ottawa Electric Company has completed a line of poles. The effect upon the appearance of the City is detrimental, as, in order to protect its own lines, the Company has erected very high poles upon which, throughout the fine thoroughfares of the Capital of the Dominion, double lines of wires are now hung.

The competition which had thus come about has tended to a large increase in the general use of electricity for lighting and power, and a recent addition has been made to the municipal system by the construction of a new system of street lamps along 2½ miles of main business thoroughfares. The cost of this installation has been partly assessed upon abutting property by a monthly payment per foot frontage; so that the business community is providing the capital expenditure as well as contributing through taxes to the increased lighting of these streets.

Much has been said, and much credit has been claimed by the Hydro-Electric Power Commission upon the strong financial position of the Ottawa Electric Company, in spite of the activity of municipal operation, but an investigation of the nature of the two competing businesses makes it clear that this result is one which is also apparent to some extent in the case of municipal operation in other cities, where private operation is in active competition. From the latter, a considerable amount of unremunerative business of the small domestic class is transferred to the municipal system, while the larger consumers and the general power business is more actively sought and is retained, to a large extent, upon the privately owned system. The business of the private company, therefore, takes on a more favorable aspect as it becomes free from the erratic and expensive class of domestic lighting and is also free from the operation of street lighting service.

It is to such causes that the maintenance of the credit of the private competing corporation is to be traced, coupled with the fact that in this instance the private company has a relatively small bonded indebtedness. Thus, the proportions which the bonds issued upon the municipal system bear to those upon the private system is 38%, but the gross business of the municipal system is barely 27%. On the other hand, the number of consumers upon the municipal system is 38% of that upon the private system, confirming the fact that the larger number of small consumers are connected to the municipal service.

A general review of the results in the City of Ottawa, of the influence and action of the Hydro-Electric Power Commission, seems to lead to the conclusion that the City could and should have been better advised by the Commission than to acquire the system and to enter into the arrangements which it has done, and that comparatively little advantage has resulted to the community as a result of the combined action of the Commission and the Municipality, and certainly no advantage from a financial standpoint which could not equally well have been secured by establishing a reasonable system of regulation of the rates of the private corporation; the financial strength and capabilities of which for good and permanent service, would have been greatly strengthened by the avoidance of the present system of competition, which has been productive of very little result in the matter of actual rate reduction. Had this course been adopted, the municipality would have retained in its treasury the $500,000 of its investment upon the doubtful value in the system which it now owns, the maintenance and renewal of which must necessarily cause heavier burdens to fall upon the ratepayers as time proceeds.

CHAPTER XI.

THE BIG CHUTE SYSTEM.

IN the course of its operation the Hydro-Electric Power Commission has undertaken the extension of transmission lines through part of the Counties of Simcoe and Grey, a system entirely independent of the Niagara circuit, but in which the methods of the Commission operate in a somewhat similar manner.

In this locality a private corporation had acquired the water rights, and constructed a hydro-electric plant at a water-fall known as the Big Chute, at the outlet of the Severn River, the largest development of hydraulic power within a radius of seventy miles.

The corporation, known as the Simcoe Railway and Power Company, is an Ontario corporation, the bonded indebtedness of which has been most conservatively proportioned, and is not in excess of one-half of the actual value of the physical properties owned by the Company.

The development, owing to natural features of location, was constructed at very moderate cost, and has a present capital of about 4,000 horsepower, and an ultimate capacity of about double that amount.

Upon the water rights the Company pays the Dominion government a minimum rental of One thousand dollars a year, and an annual rental of fifty cents per horsepower.

The Company also constructed a transmission line from the power plant to the town of Midland, at which point it also erected a transforming station, and entered into negotiations for the extension of transmission lines therefrom, to the towns of Penetanguishene, Collingwood and Barrie, and the villages of Stayner, Elmvale and Cold Water.

The largest community in this vicinity is the City of Owen Sound, which has, until a recent date, been the terminal and port of the Canadian Pacific Railroad; and around the industries thereby created, a population of about twelve thousand has grown up. The recent action of this railroad and others, in establishing new ports at Port Victoria and Port McNicholl, has transferred this business to those places, and is rapidly building up an important center, much nearer to the transmission system of the Simcoe Company, than the town of Owen Sound.

Into these circumstances the action of the Hydro-Electric Power Commission has introduced a new element—commencing with the proposition upon its part, to the Town of Midland and the other communities, which were about to receive the service of the Simcoe Company, to the effect, that any arrangements for such service should be made through the Commission.

The Commission then proceeded to negotiate with the Company for a supply of power, based upon estimates of the probable usage of power in the various towns, and upon the assumption that the five small towns would utilize about 2,000 horsepower, or practically one-half of the present development of power.

The Commission made an examination of the physical property of the corporation, and practically decided for itself, the price which it would pay for the power supplied, placing a valuation upon the property, as the basis of earnings, which reduced the invested value practically to the bond issue, or no more than about one-half of the total.

The prices agreed upon were not remunerative to the Company, but the latter found itself in the position of being compelled to enter into the arrangement practically demanded by the Commission, or face the possibility of arbitrary condemnation of part or all of its property by the Commission.

Now it is to be noted that in the negotiations which were interrupted by the actions of the Commission, the various communities would have received a service without capital expenditure on their part, which service would have been of the nature of transformed current ready for service, eliminating the cost of the transforming apparatus, and accompanying expenditures.

The contracts which the Commission made with the Company and with the several communities, has thrown the burden of the cost of transmission and of transforming stations and apparatus, upon these communities in the same manner as has been done upon the Niagara circuit. As an instance, the little town of Penetanguishene has involved itself in an expenditure of $15,743 upon a transmission line of 4.78 miles, and this cost, upon the developed demand for power, is very nearly $100 per horsepower.

It happened that several of the towns in this region were already operating municipally-owned electrical plants, and therefore, the question of the use of Hydro-Electric service involved consideration of competitive cost, and considerable doubt was expressed and some opposition was developed to the proposals to adopt the Commission's service, and thus throw away the invested value in the existing steam power plants, both in the City of Owen Sound and in the town of Barrie.

The circumstances and events connected with this matter in the town of Barrie are illustrative of some of the methods of the Hydro-Electric Power Commission and deserve careful observation.

The town of Barrie had operated an electric lighting department for about fourteen years, and had paid off its indebtedness of $80,000, the sum of $24,602, so that it had at the end of 1911, an investment exceeding $55,000.

The operation of this power plant had been conducted in a very careful and efficient manner, and had for a number of years produced a small margin over and above the costs, which, however, had not included provision for the depreciation of the capital investment. The situation, therefore, in which Barrie was placed was the abandonment of its fixed investment, upon which further payments are annually accruing, in favor of a service of the Hydro-Electric Power Commission, which involved a further expenditure of $7,000 upon new apparatus, superseding the existing steam appliances.

The scheme offered by the Hydro-Electric Power Commission, involved capital expenditure upon the transmission system, which upon the assumption that the city could utilize 700 horsepower—more than twice as much as it has been able so far to utilize—would cost per horsepower $104 to $156, or at least one and one-half times as much as a new steam power plant would cost.

The price at which the service is to be provided was based upon the purchase of energy at Midland, ranging from $16.50 to $21 per horsepower, dependent upon the amount consumed by other communities, and upon the basis of Barrie's use of 700 horsepower, the price to that town was estimated at $34.14, for a service at 2,200 volts, requiring transformation by the town for commercial and municipal purposes.

This price was, of course, only an estimate, but the contract into which the town entered with the Commission required it to pay the fixed and other charges upon the investment, additional to the cost of the power purchased on its behalf, and to these costs would naturally have to be added the fixed charges upon the town's present investment and its additional investment, together with the operating costs of municipal distribution.

Under the actual conditions of the agreement and of the financial investment of the town, the cost of the service cannot be as low as that of the steam power plant, and is probably largely in excess.

Considerable discussion took place upon this subject in the town, and the arguments that were used, and the action that was taken by the Hydro-Electric Power Commission, eventually resulted in a favorable vote of the ratepayers, upon which the agreement was concluded. The Commission employed its engineers in canvassing possible customers for the power to be purchased by the city, among the assumed additional sources of consumption of energy, being a new water-works power plant, operated by electricity.

During the agitation which preceded the vote of the ratepayers in June, 1912, a public meeting was held, at which the Chairman of the Hydro-Electric Power Commission made one of the addresses which have characterized his advocacy of the system under his control, which throws an interesting light upon the manner in which taxpayers are influenced, and in point of fact, are misled, by ingenious appeals to their imagination, and by mis-statements and half truths and comparisons without any definite statement as to the real facts and conditions bearing upon the case.

A significant fact in this instance is that the influences brought to bear upon the taxpayers, resulted in a vote in which out of a total of 1,980 qualified ratepayers, only 460, or 23 per cent. of the total took part in the vote, of whom 414 constituted a majority in favor of the adoption of the Commission's proposals, together with the addition of $7,000 to the fixed indebtedness of the town.

CHAPTER XII.

THE COMMISSION AT PORT ARTHUR.

THE Cities of Port Arthur and Fort William are situated within five miles of each other at the extreme northwesterly end of Lake Superior, within the Province of Ontario. Both are large centers for shipping, and of the two the harbor facilities of Fort William are somewhat superior to those of Port Arthur, as it is located at the mouth of the Kaministiquia River and has the benefit of river frontage for docking purposes.

The two cities have grown up alongside of each other, and at first were almost exactly equal in population, but the relative growth of the two populations during the past ten years, indicates a substantial advantage in favor of Fort William, the cause of which can be traced to the course of action of the City of Port Arthur, in respect of its public utilities and of commercial corporations, and in particular to its conduct and operations in connection with the

Hydro-Electric Power Commission of the Province of Ontario.

A comparison of the financial status of the two cities shows that, with a less valuation, Port Arthur is carrying a heavier burden of debt; the difference being due to the bonds issued for Electrical Power purposes.

	Fort William	Port Arthur
Assessed Value	21,632,855	15,215,437
General Debenture..........	1,502,129	1,272,478
Water Works Bonds.........	880,500	792,775
Street Ry. Bonds...........	500,000	604,334
Telephone Bonds...........	199,000	159,500
Local Industry Bonds guaranteed		200,000
Electric Bonds.............	227,150	481,500
Total	3,248,779	3,510,587
Sinking funds, 1912........	393,143	220,489
Net Debt	2,855,636	3,290,098

Relation of Net Debt to assessed value	13 per cent	21.6 per cent
Difference between total debenture debts	$261,779	
Difference between electric bonds	$254,350	

The two cities jointly operate through a Commission, an electric railway system connecting the two communities, and both cities also operate municipal telephone systems and water supply.

The City of Fort William owns its street lighting distribution system, upon which it has expended a sum of approximately $227,000, while the City of Port Arthur has constructed a power and light distribution system, together with a hydro-electric development, situated upon the Current River, upon which there has been expended $480,000.

The Current River plant and development was constructed in such a manner as to afford comparatively little security of permanent operation. The development itself consisted of a dam, part of which was an earth-fill, extending at right angles across the Current River, which was dammed back at several places above the development for storage purposes.

The power plant installed by the municipality is of a total capacity of 1,800 horsepower, having a capacity upon the minimum flow, of 1,020 horsepower. The deficiency in flow in this stream was sought to be remedied by the construction of the upper dams above referred to, which, however, proved to be the source of a disaster which occurred in 1908.

The City of Port Arthur, recognizing the fact that the city development upon the Current River was of a limited character, entered into an agreement with the Kaministiquia Power Company, under date of 31 December, 1907, for a limited supply of power, with a minimum supply of energy of 200 horsepower, at the flat rate of $25 per horsepower, for a period of ten years, to expire the 15th day of November, 1918.

The Corporation retained the power to cancel this agreement at the end of any yearly term, upon giving the Power Company twelve months' notice. The Company agreed to sell to the municipality at the same rate, power as might be required by the city, up to 500 horsepower.

Under this agreement a connection of the required capacity was made and the city proceeded to utilize the energy so far as might be required to help out the operation of its development upon the Current River.

About this time, and while this agreement was still in force, the Hydro-Electric Power Commission of Toronto began to make enquiry into the conditions of the water powers upon the

Kakabeka Falls, but there does not appear at this time to have been any demand on the part of Port Arthur for the interference of the Hydro-Electric Power Commission.

In 1908, a disaster occurred, which has been previously referred to. Upon the collapse of one of the upper dams, the body of water thus released, swept down upon the main development, carrying away the earth-fill; the solid dam followed and a complete wreck resulted. The water, in the course of its passage below the dam, carried away about one-quarter of a mile of park property, with municipal roads, and also several hundred yards of the roadbed of the Canadian Pacific Railway, upon which it unfortunately happened that a freight train was in course of passage, so that the occurrence was accompanied by the loss of several lives, damage suits for which have been instituted against the city.

The damage inflicted upon the railroad was repaired by that organization, and negotiations for the settlement of the cost resulted in an arrangement by which the city agreed to release its claims upon the railroad for certain taxes which had been in dispute, and to make a reduction in the future taxation upon the property of the railroad within the area of the city.

The cost of those concessions to the city may be estimated at approximately one-quarter of a million of dollars. The damage to the public parks has been in part repaired, and will when completed, cost the city approximately $60,000.

In spite of this experience, the city proceeded to reconstruct the dam and replace the earth-fill, for the purpose of its utilization in connection with the service of the Hydro-Electric Power Commission, the circumstances of which are as follows:

The Kaministiquia Power Company is a corporation owning the concession and various water rights at Kakabeka Falls and upon Dog Lake, and organized for the purpose of serving the district in which are situated the two cities, of Port Arthur and Fort William.

This corporation has a present development of a capacity of 25,000 kilowatts at Kakabeka Falls, operating upon a fall of 180 to 190 feet, and readily capable of further development to not less than 35,000 horsepower. Of this development, an output exceeding 12,000 is at present utilized, mainly in the City of Fort William.

This corporation supplies electric energy to the municipality of Fort William upon terms to be hereafter referred to; and also supplies the large industries such as elevators and mills, which have become established in that city. It also operates the street railway through its service to the municipality, as far as the boundary between the two cities.

So far as Port Arthur is concerned, it is barred by the action of the municipality from commercial sales within the City of Port Arthur, and supplies only a limited amount of power to the Hydro-Electric Power Commission of Ontario, which transforms the current and supplies it to the City of Port Arthur.

The circumstances under which this condition arose, in Port Arthur, form a remarkable illustration of bad faith on the part of the municipality, induced by the direct influence of the Hydro-Electric Power Commission; a course of action which has reflected not only upon the good name of the community, but has injured the prospects and retarded the progress of the City of Port Arthur to a marked extent.

Upon the collapse of the Current River plant in Port Arthur, which occurred in the early morning of the 27th of May, 1908, the municipal authorities telephoned at 6.30 A. M. to the General Manager of the Power Company, and informed him of the disaster, and asked for the help of his company, as the city was left without power for light and for the operation of the street railway.

In response to this request, the Superintendent of the Company brought every man in the Company's service upon the work and took from the stock of the Company their cable and all materials available, and by 7 P. M. the same evening, a connection was erected and completed, the city was lighted, and the street railway started into operation.

This action was taken on the mere verbal understanding to the effect that the city would pay the cost of the connection, and the Company proceeded to secure the service of the city by a permanent rearrangement of its feeders, and to set aside for the service of Port Arthur at its power station, a complete unit of 7,000 horsepower; the service being continued in this manner until the 5th of July following.

The municipality of Port Arthur then entered into negotiations with the Company for the continuance of the service under a permanent agreement, and the settlement of terms was reached, which was embodied in an ordinance and an agreement, which was passed by the Council and executed by the Mayor, on behalf of the city and of the company.

This agreement, dated October, 1908, expresses the desire of the city for the erection of a direct connection between the city and the Kaministiquia development, and the agreement between the parties that the Company should construct a transformer power station within the city to cost approximately $40,000, and to have a capacity of 3,000 horsepower.

This agreement further provided that the city would be obligated to take only 400 horsepower at a price of $25 per horsepower, or any additional power that it might require, at the same price, for any and all city purposes, and for sale for lighting purposes and for small power purposes, up to 10 horsepower.

The Company in consideration of this arrangement, was conceded the right to supply commercial power in Port Arthur, making contracts direct with consumers. A special agreement was made to the effect that the City of Port Arthur should receive as favorable rates and conditions as the City of Fort William, and in addition, the Company agreed that so soon as the total output in the City of Port Arthur and of Fort William should aggregate 15,000 horsepower, the price would be reduced to $20 per annum, which agreement it may here be noted was also in effect in the Company's agreement with the City of Fort William.

This contract was signed by the Mayor and by the Company, in pursuance of the by-law passed by the municipal Council of Port Arthur, on the 18th of October, 1908.

The terms of this agreement were fair to both parties and very favorable to the city in its then situation, inasmuch as the arrangement thus concluded, relieved the city of any necessity for spending money upon the re-constitution of the Current River development, and afforded the city ample service and power reserves, with every prospect that within a comparatively short period of time the cost of power would be reduced by 20 per cent., and in addition, the city was relieved from the necessity of constructing and maintaining heavy power connections for industrial purposes, and would have secured on a desirable site in the center of the city, an up-to-date transformer station, which site would have had to be purchased by the Company, and rates and taxes paid upon the property.

Moreover, the interest and co-operation of the Power Company was secured towards the establishment of new industries which in the absence of this agreement, in view of the inability of the city to provide a secure service of power, were settling in Fort William, rather than in Port Arthur.

Into this satisfactory situation the interference of the Hydro-Electric Power Commission interposed an effective obstacle when the contract was brought in the usual course, before the Ontario Legislature for confirmation, on which occasion it was opposed by the Hydro-Electric Power Commission, which brought to bear such influence upon the representatives of the city that the confirmation of the agreement failed of passage, and the city repudiated the agreement and entered into a contract with the Hydro-Electric Power Commission.

By this course, the City of Port Arthur not only lost the advantages above mentioned, but lost the investment and taxation upon the property of the Company within the city, and also the opportunity which the agreement included, of having the overhead lines placed underground whenever so desired.

The Company finding itself placed in this position by having the ratification of its contract refused, was compelled to submit to a new arrangement which was practically forced upon it by the action of the Hydro-Electric Power Commission, under which it agreed to sell current direct to the Commission by a high tension connection extending as far only as the boundary of the city, nearest to their main transmission line.

The terms of this agreement were given in full in the Evening Chronicle of Port Arthur, 25th of September, 1909, and were discussed by the Municipal Council on the 28th of that month. At this meeting answers to the various questions which had been put to the Hydro-Electric Power Commission, were read; also a report from the Engineering Department of the Commission upon the cost of power generated by the city at its Current River development, which was stated to be not less than $30 per horsepower.

The Municipal Council was influenced by the usual arguments as to municipal ownership, and by the attractive suggestion that all the funds necessary would be found by the Provincial government, to meet the expenses of the contract between the city and the Hydro-Electic Power Commission; but it is noticeable that this agreement is not for the same period as in the case of other cities, but is only for a period of ten years.

The contract provided for the construction by the Commission of a transformer station with an equipment for 1,100 horsepower, and for the sale of the current purchased by the Commission from the Power Company to the city, at cost, inclusive of fixed charges upon the capital outlay.

Comparing this proposal with that included in the terms of the repudiated contract, one cannot but be impressed by the inadequate substitute thus accepted by the city, by which the city was practically compelled to proceed with the expenditures which it has since made upon the reconstruction of the Current River dam, and to pay for energy purchased through a second party, instead of dealing direct, without any provisions for a reduction of charges upon the increased Fort William load, and for an equipment of only one-third of the size which the Company had agreed to construct.

In addition to this, the Commission, in its efforts to reduce the capital cost, contracted only for a duplicate line of supply from the Power Company, and a further unfortunate result of this arrangement was that the city was compelled to get along with an ineffective temporary system composed in part of the temporary connection from the Power Company, and the use of the crippled plant at Current River, for no less than two years.

The service of the Hydro-Electric Power Commission did not commence until December, 1910, during which the city paid the Company for service at the rates for temporary supply. During this time, too, the service of the city was naturally unattractive to industrial establishments, and while there was some growth of power demand, it was not commensurate with the growth of demand for industrial purposes in the City of Fort William.

The situation of the station has involved the construction by the city, of heavy low-tension feeder lines, extending down the hill to the center of the city, disfiguring in appearance to a fine residential portion of the city.

The capital expenditure of the Hydro-Electric Power Commission upon the Port Arthur transmission, and sub-station and equipment, as of April 30, 1912, was $69,959.84.

This amount does not include duplicate equipment, which as described in the Port Arthur Daily News of March 17, 1911, will require a further expenditure of	$12,000.00
Upon this amount the fixed charges and costs of operation, etc., inclusive of depreciation at the rate of 4½%, are estimated by the Commission to amount to a net sum of	$10,792.64

The terms of the contract with the Power Company are as follows:

Up to 2,000 horsepower	$17.00
From 2,000 to 4,000 horsepower	16.00
From 4,000 to 6,000 "	15.00
6,000 and over	14.00

The average demand upon the system of the Power Company has been 1906 horsepower, the loss by transmission and transformation being 106 horsepower. The power received by the city from the Hydro-Electric Power Commission has cost the city $23.84 per horsepower.

The price thus paid by the city is not entirely represented by the figure above given, because part of the cost of the continued operation of the Current River plant is incurred upon its operation in keeping down the peak load of the Hydro-Electric Power Commission's supply, costing approximately $3 per horsepower purchased, bringing the price of power to $27 per horsepower.

There are in addition to these costs, sundry items which would not have been incurred had the supply of power been taken from the Power Company, which add another $1.50 to the comparative cost of the service, and making the total cost about $28.50 for the power that could have been purchased under the agreement for $25.

Station lighting and heating	$312
Water and pumping	120
Superintendence and inspection, Administration and office, share of	1,750
To which may be added loss in taxes	500
Making a total of	$2,682

It is evident, therefore, that the city gained in no respect by its contract with the Hydro-Electric Power Commission. In point of fact, by reason of the repudiation of the former contract the municipality is now paying more for its power than would have been the case had it maintained its contract obligations. The city has assumed the risks and expenditures of the business from which it had already suffered seriously, and some of which do not appear in the operating costs, and headed off the Company's private enterprise and initiative in the securing of business and new industries for the city and deprived itself of taxation upon the Company's business and property.

During the period of delay which was caused by the cancellation of the Company's contract in October, 1908, until the end of 1910, when the service of the Hydro-Electric Power Commission commenced, the city was involved in a temporary service, which cost a considerable sum of money for temporary work and for a supply of temporary power from outside sources, amounting to as much as $40,000. It may be noted that during the period above referred to, the Power Company was called upon to supply temporary service of power to the city, on five different occasions, for periods of from two to six months, on an agreement, terminable at a month's notice. This service was taken by the city at the Company's lines in Fort William, at a price of $2.10 per horsepower per month, or $25.25 per annual horsepower.

The cost of this service from that point, with all line losses and temporary lines, was borne by the city of Port Arthur. Had it not been for the aid thus rendered by the Power Company upon the occurrence of these necessities, due to the inadequacy and failure of the municipal power plant, the city would have been put to great loss and inconvenience, and it is evident from these facts that the dealings of the Company with the city were characterized by a spirit of fairness and friendliness, and that no reason can be found therein for the action taken by the city, in the repudiation of the contract in 1908, which was evidently due to pressure brought to bear upon the municipality and the optimistic statements as to the low cost at which the Hydro-Electric Power Commission would be able to secure a service.

The effect upon the industries already existing in Port Arthur has been to decide several of them to continue the use of steam power, and the general tendency in the introduction of new industries in the vicinity has been towards their location in Fort William in preference to Port Arthur. That the result is disastrous to the interests of Port Arthur, is indicated by the relative growth of the two populations during the past ten years:

Town	Year	Population
Port Arthur	1901	3,214
	1911	11,216
Increase	8,002	
Fort William	1901	3,633
	1911	16,498
Increase	12,865	

To these figures may be added the following comparative statistics:

	Fort William	Port Arthur
Building permits 6 months, 1912	$1,700,000	$700,000
Assessed value per capita	1,311	1,357
Debenture debt “ “	196	312
Per cent of sinking fund to date	12.2	6.3
Total debt of Port Arthur as unity	94%	100%
Sinking fund Port Arthur as unity	179%	100%

In studying the above figures it will be observed that the relative burden carried by Port Arthur is extremely heavy and that the sinking fund provisions are obviously low. Thus a comparison of the percentage relation of the sinking fund to date, shows that upon the same basis as Fort William, Port Arthur should have set aside $428,291, as compared with an amount of only $220,489.

The above considerations do not include Port Arthur's obligations for the capital cost of the Hydro-Electric Power Commission's expenditures.

The various issues of debentures in Port Arthur have been made for periods of fifteen to thirty years, and the city has recently secured the ratification of a plan for a consolidation of some of these debentures on a forty-year period.

The accounts of the city for 1911, show that considerable capital expenditure continues to be made by the City of Port Arthur, upon electrical purposes; having expended chiefly upon the reconstruction of the wrecked development, on the sub-station, and upon electric lighting distribution work, a total of $72,638.87.

The accounts of the city for the year 1911, presented to the Council, 25th March, 1912, by the City Auditor, showed that the method of presenting the financial operation of these utilities is, to charge to the Power Department the purchase of power and cost of operation of the power plant, with a part of the interest and sinking fund and annual instalments due upon the power debentures. The energy is then charged at less than cost to other departments, resulting in showing a net loss on the power department of $8,870.15.

The power thus sold to the lighting department below cost, is then sold by the latter to consumers at 100 per cent. profit, and part of the cost of administration of public utilities is charged against these returns with part of the interest and sinking fund due on debentures issued for electric lighting purposes. This results in a large apparent net gain by the operation of electric lighting.

The method under which the separate accounts are charged, with less than the full fixed charges and costs results in an apparent profit on the electric light service, of $20,838.22, modified by an apparent loss in Power Department of $8,870.15, or a net apparent *surplus* of $11,968.07.

But the actual payments shown in the revenue accounts divested from such devious methods disclose a different result. Power purchased, $42,913.49; operation and maintenance Power

Plant, $12,864.85; distribution of electric light, $5,571.81; office and salaries, $2,880.00, or a total of $64,230.15.

The fixed charges in the separate accounts of the two departments are given as $31,769.21, but the debenture account shows that there should have been paid by them $42,190.28, or a total of $106,420.43.

The revenue was as follows: Electric light consumers, $78,129.62; sale of power, A. C., $19,220.74; sale of power, D. C., $4,330.50, total, $101,680.86, showing *deficit* of $4,739.57.

Since the collapse of the dam in May, 1908, the city has issued bonds in respect of the same development, amounting to $103,000; for cables for temporary services, $19,000; for electric pumping machinery, $16,500, and expended out of revenue in 1911, $46,185, adding to its indebtedness $184,685.

In contrast to the conditions brought about in the City of Port Arthur by the offices of the Hydro-Electric Power Commission, the situation in Fort William is of interest.

This municipality has a contract with the

Kaministiquia Power Company for a supply of energy at the price of $25 per annual horsepower, and at a tension of 2,700 volts delivered at the Power Company's sub-station, located within the city limits and utilized by the municipality for its municipal lighting services, for the operation of the joint municipal railroad, and for supply to the small consumers of lighting and of power.

The result is advantageous to both the residents and to the industries of the city; the rates for domestic service being 5c. per kilowatt hour, less 10 per cent., as compared with the domestic service in Port Arthur, which upon several instances, works out about 7c. per kilowatt hour.

The results are satisfactory from a financial standpoint, as the city on a gross revenue of $80,000 made a profit of $10,000 upon rates which are more advantageous to consumers.

Service has been afforded to this city for a number of years, without interruption, and the system of transmission is provided by the Company in triplicate, while provision is made for reserves of transformer capacity on the municipal service.

The growth of the use of electricity under these circumstances, has been continuous and every industry utilizes electrical service.

The Company supplies about 1,500 horsepower for municipal lighting and small motor service below 10 horsepower, but also distributes about 9,000 horsepower in various commercial and industrial establishments.

The contract of the Company with the City of Fort William contained the provision that the prices should at all times be no less favorable than the cost of the service of the Company to other communities, and therefore, some interest has been expressed, and some enquiry made on the part of the municipality of Fort William, into the comparative cost of the service purchased through the Hydro-Electric Commission by the City of Port Arthur.

These investigations have so far shown that the cost of the power in the City of Port Arthur is in excess of the price which is being paid by the City of Fort William.

A consideration of the whole of the foregoing circumstances indicates that the prospects of both cities have been to some extent injured, but that the growth and development of the City of Port Arthur have been particularly affected as a result of the interference of the Hydro-Electric Power Commission.

CHAPTER XIII.

THE WAY OUT.

STUDY of the governmental operations as conducted by the Hydro-Electric Power Commission leads to the inevitable conclusion that they have been productive of considerable inequality, and even of unfairness. And whatever may be the view taken of the actions of the Commission in its dealings with municipalities and with corporations, and also as to its policy of concealment of facts from the public, there can only be one opinion as to the financial results, namely: that they are not of a satisfactory character.

As now operated, the facts and figures have disclosed the advantage which is being secured by larger communities, at the expense of the smaller, and the benefits which are being pocketed by a very limited proportion of the population, at the expense of the majority. Even if it is conceded that the indirect advantages of electric illumination for public purposes is shared by the general public, that portion of the public which secured such advantages, is by no means the whole of those who are directly or indirectly contributing towards its cost.

The only excusable method by which such a process can be carried on, is by a system of charges, which will bring back to the public treasury, not only the actual outlay, but some benefit which shall revert to the special advantage of those who are unable to secure material benefits from the actual use of the convenience of electricity.

The essential difficulty which lays at the root of this matter is, that electric service is not of the character of a general public utility similar to such necessary convenience as a supply of water; or even of such indirectly general advantage as public works of the nature of harbors and canals. Upon such public improvements, the general funds of the community may properly be expended, because the results are far-reaching, and are not of such a nature as to produce a personal profit to one class of the community, rather than another; but the distribution of electricity is of a totally different character, being divided into two classes, namely; that in which the use of the service is a source of profit, and that in which its use is a personal convenience.

Only to a very restricted extent can electricity be regarded as a necessity, whether public or private. To expend the funds of the general community upon such a purpose, therefore, necessarily results in preferential advantages to a limited portion of the community.

The nearest parallel would probably be the governmental purchase of coal and its re-sale to those who make a commercial use of the commodity, and to those who make a convenience of its use. If such a development of governmental operations were to take place, it is readily conceivable that a large portion of the population which finds no use for that particular kind of fuel, might with propriety, object to its credit, as well as its taxes being utilized for the benefit of the two classes of users.

A governmental operation of this nature

would seem to require such methods as would produce for the benefit of those indirectly contributing to the system, a return in the form of profits applicable to their benefit. Were this to be done in the case of the electric service of the Hydro-Electric Power Commission, it is clear that the prices at which the service is supplied, should be such as would return not only the cost, but such an amount of profit as would represent a commensurate advantage in reduction of taxation to the rural inhabitants and to the poor, who derive no direct or indirect benefit from the Government system.

When the facts and circumstances of this situation are clearly understood by the public, the people of Ontario will not be behind others in an intelligent demand for a reasonable and fair treatment of the subject. The whole situation in Ontario appears to have grown out of the speculative attempt to experiment with the difficult matter of electric service, in the manner which has developed, rather than to accept the methods adopted by other Canadian communities dealing in the public interest with private corporations, by means of governmental control.

The whole scope and object of the operations of the Hydro-Electric Power Commission is limited to this effect. It is no new experiment except in the combination of governmental and municipal efforts in the direction of competition.

The process has been under trial for a quarter of a century, and its practical results have been so ineffective and even destructive, that well-informed public sentiment has generally decided in favor of the principle of regulation rather than competition even where the latter is secured by private capital.

The Civic Federation in its annual report published January 20, 1913, says, on this subject:

> "Whether, in the industrial field, we should regulate competition or regulate monopoly is a debatable question; but there is one field in which there is little room to-day for dispute on this question, and that is the public utility field. There is a monopoly that should be regulated, and this monopoly is conceded to be a natural monopoly. Twenty-five years ago the general theory was that the best way to secure better gas, electric light, street and steam railway service was to encourage competition by granting franchises to as many corporations as would accept them. To-day, every student of the question, as well as the general public, accepts the principle that all public utilities are natural monopolies, to be placed under regulation by the Government, either Federal or State.

> "The reason for the complete reversal of sentiment in reference to municipal utilities was the very practical discovery that there was no way to force two or more gas companies, electric light companies, or street or steam railway companies serving the same territory to compete, because, if they really competed, it drove one or the other of them into bankruptcy, and the public had to suffer by having two or more plants on hand to do the work that could just as well be done by one. Furthermore, the more companies there were the more public streets were torn up, with all the contingent disadvantages arising from the necessary repairs, duplication of capital, etc., whereas one company, regulated by a Public Commission, could secure for the people proper service at a fair cost.
>
> "It was after this experience that the conviction was firmly fixed in the public mind that competition must go and regulation of municipal utilities should come."

These important and well established conclusions answer the enquiry, whether the Experiment under more careful, expert, and economic methods would not have brought about the anticipated results without the present complications.

There is very little value in assertions to the effect that small communities could not expect to obtain electrical service from private sources, excepting by Governmental operation. Such small communities have generally succeeded in securing whatever material advantages in these directions they were properly able to support, and the attempt to supply such places with electric service, is not necessarily productive of any material advantage or increase of the wealth of these communities, but often rather the reverse.

The expenditures into which the general public have been led in contributing towards the support of this vast governmental speculation, are such as must inevitably weigh heavily both upon the credit and upon the resources of a large number of communities in Ontario. It is probable that the situation has been largely brought about by the lack of care in examining and analyzing the details of the subject, and by the exaggerations and over-statements in which those unacquainted with the limitations of electricity, have indulged.

The hard facts remain, that the experiment in Ontario has fastened upon the community an enormous financial burden, the effective results of which are inadequate and uneconomic, and the benefits such as they are, unequally and even unfairly distributed.

The effects have flowed from the Provincial speculation into the municipal operations, in which there has been excessive expenditure of capital and of current funds largely in advance of the real needs of the communities. Duplication of existing systems, excessive capital investment thereon, and otherwise unnecessary expenditures upon extensive street lighting and water pumping, have resulted from the unfortunate conditions in which the municipalities have become involved by their participation in the scheme.

That this condition has attained the proportions now existing, is doubtless largely due to the policy of suppression of information, which the Hydro-Electric Power Commission has adopted and followed,—a policy broken only by the disclosures of the New York State Legislative Committee. This suppression of information has extended, not merely to the people, but to the representatives of the people in Parliament and to the Ministry in charge of public affairs. That this is actually the case, was made evident by a conversation of the writer with one of the present Ministry, who expressed astonishment at the facts relating to the burden of indebtedness which the Hydro-Electric Power Commission had rolled up, combined with the expenditures of municipalities.

Added to all of this, is the loss which the community as a whole, has suffered by depreciation or stagnation of the value of the securities of private corporations, and some loss of returns upon the funds invested therein by citizens of the Province; and the loss of the taxes which the communities could have secured upon the increased values accompanying an increased business of these corporations. If all these elements could be ascertained, and their capitalized value determined, it would result undoubtedly in figures, which added to the public expenditures, would make the resulting service afforded through the Hydro-Electric Power Commission, one of the most expensive speculations in which the people of a State have ever become involved.

The hard common sense of the Canadian people would never have allowed the situation to become what it has, but for the suppression of the facts and information in connection therewith.

The enquiry naturally occurring to every thoughtful person acquainted with these facts is, what is to be done to remedy the conditions into which the people of Ontario have been led by the interested agitators and politicians who have conducted the affair.

To this enquiry, the reply clearly is that, in the first place, the existing prices for electricity must be so changed and raised as to produce a more than sufficient revenue to cover every possible form of public expenditure; and secondly, that the inequalities and unfair treatment which have been brought about, must be readjusted to the public satisfaction.

It must be plain to any one merely examining the financial results, that the City of Toronto has managed to secure the major share of benefit in every direction.

The Commission has acted and is acting only as a middle man or merchant of electric energy purchased from a third party and resold. It is no loser by the fact that a small town at the end of a line, consumes only a small amount of energy at one particular time, because whatever may be the expense or result of that service, the cost of it is charged back, in theory, at least, upon that community.

The theory, therefore, of the charges which have been made to the communities under this system of governmental operation, is wrong at base, and the communities, one and all, remote or near, are entitled, as participants in the support of the Government, to absolute equality throughout. Such a shrewd observer of the situation as the City Auditor of Toronto—Mr. Walter Sterling—has already perceived this situation, and has drawn public attention to the unsatisfactory character of the arrangements by which a purchase of power is made upon the basis of a mere maximum demand. Whichever way this system is manipulated, it is to the disadvantage of the small community, which is unable to provide itself with expensive appliances applicable to the reduction of its peak load or maximum demand, while the larger municipality can readily afford such expense.

These considerations clearly point to the propriety of a demand upon the part of the various communities now served, for equality of treatment in the matter of charges for energy. The fallacious inducements which have been held out to the various municipalities as to the possibilities of so-called "resale" of the power purchased, are mere clouding of the issue, evidently intended to mislead those technically unacquainted with the subject. The method and system inure only to the benefit of those consumers of energy to whom its use is a direct source of profit. To put the matter more simply, since the peak load or maximum demand purchased by a town or village, is mainly composed of domestic lighting and of public illumination, the sale of energy during the hours of daylight, is mainly to manufacturers, to whom a reduction in price is a source of personal profit. It has been pointed out, that no part of this profit has so far found its way, in the shape of increased wages or reduced cost of product, into the pockets of the public and of the poor. The community is therefore paying for the highest part of its use of power, and endeavoring to make up the loss upon its operations by affording to certain interested persons, a supply of energy at a less price than that which they can well afford to pay.

That such a system may be in operation in certain privately owned systems, is nothing to the point, since private business is conducted at the risk of those investing therein and such inequalities can be regulated by proper authority. But where, as in this experiment, the risks and the losses are in large part shared by people who have no interest whatever in the results, and no benefits derivable therefrom, the same methods cannot, in justice, be followed.

If the principles under which this experiment is conducted are to be those which should govern the operations of governmental finances, then there should be preferential treatment in the matter of taxation. Assuming that governmental operations of this sort should be applied to railroads, what could be said in these days of a governmental system, which not only established preferential rates, but made good the losses thereon, by the taxation of the general community?

The crux of this entire question will be developed when the question of the elimination of the present inequalities is faced, for it will inevitably result that large beneficiaries, such as Toronto and London, will be compelled to pay their fair share of the whole burden, apportioned upon their utilization of its advantages.

The result of the raising of the present rates in those communities, would inevitably be to show the weakness of the whole scheme, in its attempt to force, by the credit of the people, an unnatural and excessive competition in electrical production, at points, in places, and under conditions to which such a competition was naturally unsuited; but the fact that this is the case, cannot stand in the way of reasonable justice to the people of Ontario.

The average cost of the energy which has been supplied through the auspices of the Hydro-Electric Power Commission, has been concealed, because important elements have been ignored. Others have been set aside, as in the case of the sinking fund, and no one appears to have been made aware of the fact that the Commission's own expenditures are involving the Province in additional expense directed practically to no other purpose.

As time proceeds, the present system will grow larger, less efficient, less up-to-date; while on the other hand, competition from private sources will grow more strenuous. Improvements in steam and other machinery are continually advancing, and the governmental operation will be at a progressively increasing disadvantage.

Under the present conditions, no provision is being made for such contingencies in the use of an art, which is, at the present time, hardly over the threshold of development, and liable, more than any other modern invention, to radical change and alteration.

From a practical standpoint, there can be no question that by the exercise of governmental or municipal credit, private enterprises could have supplied, at vastly less expenditure, all the convenience which has so far been secured by the offices of the Hydro-Electric Power Commission, and at fair prices under governmental regulation.

If the expenditures of the people of the Province upon that Commission, had been laid out in the direction of the care of the public's interest by regulation of the rates of private corporations and the general control of their financial affairs, a result equally beneficial, even as regards the prices charged, could have undoubtedly been secured.

It will be said by those who have so far followed this subject that, in the words of the old saw—"It is no use crying over spilt milk," and the only thing to be done, it must be conceded, is to make the best of whatever has proven to be the outcome of perhaps ill-judged methods. By some means, the Province of Ontario will no doubt eventually readjust its experiment, and place itself in line with other provinces of Canada which have taken a course of government regulation of utilities rather than the now out-of-date method of competition.

Some hardships may result from a readjustment of the financial situation in this direction, which will, however, fall heaviest upon those who have been the greediest in endeavoring to secure benefits at the expense of others. Unless the people of the Province are willing to consent to a payment out of the public funds to cover all the deficiencies created by the speculation and are prepared to contemplate a periodic recurrence of such demands upon the public treasury, then the solution of the present situation can only be found in a course which has to be followed by any honestly conducted commercial organization, namely: to place the charges for power upon a basis which will amply meet all outgoings of every description, eliminating the element of competition, and substituting a system of governmental regulation of rates.